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FIRE PREVENTION

A Treatise and Text Book on Making Life and Property Safe Against Fire

For Inspectors, Fire Marshals, Business Men, Building Managers, Shop Foremen, Superintendents of Institutions, Janitors, Engineers, Matrons and Housekeepers

WRITTEN FOR

The Chief

THE GOVERNMENT WEEKLY

By Peter Joseph McKeon

Consulting Expert in Fire Prevention to the New York State Factory Investigating Commission and the New York City Visiting Committee of the State Charities Aid Association. Formerly Consulting Expert to the Committee on Safety of the City of New York, the New York Fire Department, the Public Welfare Committee of Essex County, New Jersey, etc., etc. Author of The Fire Prevention Laws of New York and Building Insurance.

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432

CONTENTS

CHAPTER I.—The Story of How Fire Prevention Became a Science.

Fire Prevention an American Invention. The First Building with Fire Prevention. Zachariah Allen. The Factory Mutual System. The Father of Hydraulic Engineering. Perforated Pipes in Lowell, Mass. Work of Edward Atkinson. Making Fire Prevention Scientific. First Study of Causes. Fire Laboratory. Spontaneous Combustion.

CHAPTER II.—The Invention of the Fire Door, the Automatic Sprinkler, the Fire Pump and Mill Construction.

Need of a Fire Stop. Failure of Iron Doors. Use of Tin Clad Wood. Sliding Doors. Automatic Release. The Underwriter Fire Door. The Greatest Fire Invention. What the Automatic Sprinkler is. Frederick Grinnell. Getting the Sprinkler Introduced. The Parmelee Sprinkler. Features of the Improved Grinnell Sprinkler. The Need of Sprinklers. The Sprinkler and the Department Store. Slow Burning Construction; What it is. Treatment of Floor Openings. Use of Engineers in Fire Prevention. Atkinson's Associates. Atkinson's Work Summed Up.

CHAPTER III.—The National Fire Protection Association and the Underwriters' Laboratories.

Development of Fire Prevention in Other Directions. Recent Fire Inventions. Fire Prevention by Insurance Companies. Reason for National Fire Protection Association. Preparation of Standards. Tests by Underwriters' Laboratories. Reports of Tests and Lists of Approved Devices. Factory Inspection Labels.

CHAPTER IV.—What Fire Prevention Is; Its Standards and Principles.

Fire a Disease. Taking Chances with Fire. What Can be Done with the Fire Danger. Use of a Fire Expert. Caring for Outside Fires. Treatment of Fire Causes. What Makes a Building Safe. Improving Present Buildings.

CHAPTER V.—Fire Appliances and Their Use.

Principles of Controlling Fire. Appliances Necessary. Detecting Fire. Automatic Alarms. What the Watchman Does. The Use of Clocks. Interior Alarms. Fire Department Call. Fire Pails. Bucket Tanks. Chemical Extinguishers. Gas Extinguishers. The Fire Standpipe. Use of Hose Streams, Fires for Trained Firemen. Automatic Fire Extinguishing is Practical. Operated by a Match Flame. What the Sprinkler is. How Sprinklers are Installed. Sprinkler as a Fire Alarm.

CHAPTER VI.—Confining and Retarding Fire.

Principal Retarding Appliances. Fire Doors and Their Location. Construction of Doors. The Fusible Link. Fire Stops for Windows. The Exposure Danger. Use of Shutters. Invention of Wire Glass. Its Use to Make Fire Windows. What the Fire Wall Is.

CHAPTER VII.—The Treatment of Fire Causes and the Life Hazard.

Prevention as a Special Thing. Causes of Fire Can be Removed or Made Safe. Causes of Fire Are Known. Common Causes the Great Trouble. The Fire Expert's Best Service. Considering Causes of Fire in Plans and Specifications.. Caring for People in a Building. Fire and

the Panic. Need for Fire Drill. Desirable in Private Residences. Fire Drill in Schools not Adequate. What a Fire Drill Should Do. Why an Expert is Needed. Fire Danger Demands Regular Inspections. Duties of Owners and Employers. Use of Inspection Reports. The Supervising Inspector.

CHAPTER VIII.—The Bureau of Fire Prevention Law and What It Means.

Established by Sullivan-Hoey Law. Changes and Additions to Chapter. Commissioner has Control of All Bureaus. New Bureau and its Business. Chief of Fire Prevention and His Appointment. Fire Prevention Duties and Powers of Commissioner. Right of Entry. Service of Orders. Fire Hazards are Nuisances. In Case of Compliance with Order. In Case of Refusal. Liability for Costs. Appeal from Commissioner's Order and Making of a Survey. Action of Surveyors. Court Proceedings. Payment of Surveyors. Reimbursement of City. Deposit for Survey. City Can Sue for Reimbursement. Commissioner Can Vacate Buildings. Duty to Transmit Notices. Commissioner's Duty to Investigate Fires. Investigating Officer has Power of Subpoena and Oath. Municipal Explosives Commission Continued.

CHAPTER IX.—Fire Prevention Sections of Greater New York Charter.

Care of Shavings. Street Fires. Chimney Fires. Closing Doors and Shutters. Injuries to Firemen. Responsibility for Fires. Protection for Lights. Alarm Systems. Fire Appliances. Watchmen. Exit Signs. Interior Fire Alarm. Care of Fire Appliances. Fire Department Inspection. Firemen at Theatres. Duties of Theatre Firemen. Violation and Penalties. Watchmen in Theatres.
Explosives Commission. Members. Regulations. Meetings. License for Explosives. Employes. No Manufacturing of Explosives. Bonds. Violation and Penalty. Explosives on Ships. War Vessels Excepted. Criminal Liability for Deaths. Fraudulent Oil Samples. Illegal Privilege in Insurance Policy. Right of Entry. Notice of Violations. Penalty. Costs on Owner of Building. Information for Permits. Penalties and Liabilities. Payment to Informers. Suits. Violation is a Misdemeanor.

CHAPTER X.—Auxiliary Fire Appliances.

What are Auxiliary Fire Appliances. List Covered by Fire Department Regulations.

CHAPTER XI.—Fire Pail Equipments.

Explanation of Fire Pails. Manufacture. Size. Setting. Height. Distribution. Location. Filling. Sand Pails. Freezing. Person in Charge. Substitution.

CHAPTER XII.—Chemical Fire Extinguishers; Their Construction, Installation and Use.

Use of Chemicals. Carbonic Acid Gas Extinguishers Successful. How It Works. Rules for Safe Machines. N. F. P. A. Standard. Materials and Construction. Upset Type and Gradual Acid Feed, Hose and Handles. Direction Plate. Tests by Underwriters' Laboratories. Installation Rules. Care of Extinguishers. Tests and Refilling. Freezing. Use.

CHAPTER XIII.—The Fire Line or Standpipe.

Principal Parts. Piping. Risers. Branches. Cross-connections. Size of Piping. Fire Engine Connection. Siamese Connection. Standard Connection. Female Couplings. Position. Caps. Valves. Check Valves. Gate Valves. Hose Valves. Pressure Reducing Valves. Hose. Nozzles. Water Supplies.

CHAPTER XIV.—A Standpipe System for a Skyscraper.

Specifications for Singer Tower. Water Piping. Risers. Fire Department Connections. House Pump Connections. Check Valve System. Water Supply to Tanks. Difficulties with Gravity Pressures. Building Divided into Vertical Sections. Separate Tanks. Three Sources of Supply.

CHAPTER XV.—Automatic Sprinkler System.

Principal Parts. Sprinklers. Piping. Risers. Branches. Cross-connections. Small Pipes. Sizes of Piping. Valves. Gate Valves. Main Gate Valves. Floor Valves. Gate and Check Valves. Alarm Valves. Tank Alarms. Dry Pipe Valves. Water Supplies. Gravity Tanks. Pressure Tanks. Public Water Works.

Fire Pumps, Location. Underwriters' Fire Pump. Rotary and Centrifugal Pumps. Fire Engines. Non-automatic Supply. Hose Connections. Maintenance of Sprinkler Systems. Open Valves. Straps. Replacing Sprinklers. Supply of Extra Sprinklers. Instruction of Employes. Action in Case of Fire. Care of Water Supplies. Reliable Employes. Additional Equipment. Interference with Sprinklers. Cold Weather Valves. Corroded Sprinklers.

CHAPTER XVI.—Sprinkler Supervisory Service.

Necessity for Constant Supervision. Disabled Systems. Water Damage. Points of Supervisory Service. Closed Gate Valves. Low Water. Loss of Pressure. Tanks, Freezing or Heating. Trouble Signals. Leakage. Fire Alarms.

CHAPTER XVII.—Perforated Pipe Sprinklers.

Cellar Equipments in New York City. What the Perforated Pipe Is. Supply and Discharging Device. Fire Engine Supply. Siamese Connection. Regulations. Metal and Strength of Pipes. Hanging. Size. Feed Pipe. Drawings. Cast-iron Prohibited.

CHAPTER XVIII.—Watchman Service.

Protection Against Fire and Burglary. Necessary for Closed Buildings. Great Responsibilities. Care and Vigilance Required. Supervision of Watchmen. Time Recording Device. Portable and Stationary Clocks. Central Office System. Use of Signal Box and "Ticker." Schedules and "Runners." Daily Report. Combination Fire Alarm Box. N. F. P. A. Standards. Lantern Requirements. Time of Service. Patrol Periods. Stations. Watchman's Time Recorder, or Central Office System of Supervision. Iron Magneto Boxes. Wiring. Portable Watchman's Time Recorders. Records. Watchman's Lantern.

CHAPTER XIX.—Interior Fire Alarm.

Method of Operation. Fire Alarm Boxes. Wiring. Alarm Gongs. Annunciator. Batteries. Guarantee. Tests.

CHAPTER XX.—Automatic Alarm Systems.

Definition. Principal Parts. Thermostat. Conductors. Transmitters. Annunciator. Manual Alarm Box. Signals. The Compensating Automatic Alarm System. Tubing. Detector. Transmitter. Test Coil. Advantages.

CHAPTER XXI.—Communications and Their Safeguarding.

Problem of Connected Buildings. Fire or Division Wall. Classes of Communications. Wall Openings. Doorways. Belt or Shaft Holes. Windows. Wood Beams in Party Walls. No Fire Wall. Cornices. Passageways. Bridges and Tunnels. Treatment of Communications. Bricked Up Communications. Bonded Brickwork. Cut-Offs or Fire Stops.

CHAPTER XXII.—Fire Doors.

Standard Fire Doors. Materials. Wood. Tin. Hardware. Construction. Wood Core. Tin Covering.

CHAPTER XXIII.—Shaft and Belt Holes.

CHAPTER XXIV.—Iron Fire Doors.

CHAPTER XXV.—Operation of Fire Doors.

CHAPTER XXVI.—The Exposure Danger.

Exposure and Conflagration. Group Exposure. Mutual Exposure. Elements. Details. Open Spaces. Separated and Adjoining Exposure. Maximum and Minimum Limits. Modifications. Blank Walls. Oppositeness. Wind Direction.

CHAPTER XXVII.—Fire Shutters.

Types. Tin Clad Shutters; Construction and Hanging. Opening of Shutters. Sliding Shutters. Iron Shutters; Construction and Hanging. Use and Closing of Shutters. Steel Rolling Shutters; Use, Construction, Operation and Maintenance.

CHAPTER XXVIII.—Fire Resistant Windows.

Structural Defences. Fire Resistant Windows. Outside Window Guards. Development of Shutter Protection. Use of Iron Shutters. Effect of Heat and Flames. Use of Tin Clad Wood. Value of Duplicate Shutters. Objections to Shutters. Partial Protection. Use of Wire Glass. Its Value. Melting Point. Importance of Setting. Defects of Wood Frames. Incombustible and Metal Frames. Frames. Sash. Materials. Types. Glazing. Automatic Operation. Prism Glass Frames.

CHAPTER XXIX.—How to Inspect a Building for Fire Prevention.

Practice and Experience. Observation and Description. Suggestions. Don't Quarrel. Act as Instructor. Approach Owner or Manager. Badge of Authority and Inspector's Order. Help from the Engineer. Street Survey. Way to Begin an Inspection. Roof Details. Keeping Notes. Floor Records. Value of Note Books. Inspector's Shorthand. "Graft."

CHAPTER XXX.—Classification of Buildings by Construction.

CHAPTER XXXI.—Classification of Floor Openings.

CHAPTER XXXII.—Faults of Management.

CHAPTER XXXIII.—Unsafe Gas Jets.

Building Code Requirements. Brackets and Lights. Method of Correction. Wire Cages. Ceiling Protection.

CHAPTER XXXIV.—Some Unsafe Gas Appliances and How to Correct Them.

Gas Stoves. Gas Mufflers and Blow Pipe. Safe Arrangement for Gas Stove. Use of Iron Stand or Sewing Machine Frame. Gas Stove for Heating Pitch. Use of Metal Pan. Safe Arrangement for Gas Muffler and Blow Pipe.

CHAPTER XXXV.—Fire Hazards of a Gas Engine.

Exhaust Chamber. Rubber Bag. Oily Floor. Electric Spark Ignition. Cast Iron Equalizer Chamber. Floor Protection. Position of Rubber Bag. Support for Exhaust Chamber. Position of Exhaust Pipe. Dangers from Pipe in Chimney.

CHAPTER XXXVI.—Fire Resistant Packing Bins.

Use of Tin Clad Wood. Necessity for Fire Resistant Packing Bins. Failure of Ordinary Wood Box. Construction of Bin. Value of Bin. Where Necessary. Specifications.

CHAPTER XXXVII.—Safety Receptacles for Ashes, Rubbish and Oily Waste.

Danger from Rubbish. Care of Waste Paper. Use of Bins. Danger from Large Bins. Basement Accumulations. Fireproof Vault in Department Stores. Daily Removal in Paper Factories. Danger from Ashes. Use of Metal Cans. Daily Removal. Oily or Greasy Materials. Risk of Spontaneous Combustion. Favorable Conditions. Why Spontaneous Combustion Occurs. Protection by Self-closing Waste Can. Daily Emptying. Specifications.

CHAPTER XXXVIII.—Using and Storing Benzine in Small Quantities.

Danger from Benzine, etc. Use of Safety Cans. Reducing Amount in Use. Outside Storage.

CHAPTER XXXIX.—Precautions in Handling Celluloid.

Celluloid Present in Many Places. What It is, How Manufactured and How It Acts. Dangers in Working Celluloid. Sparks from Cutting and Grinding. Blower System Necessary. Use of Water Sprays. Danger from Scrap Celluloid. Proper Method of Storage. Danger from Heating Celluloid. Safe Working Temperature. Dipping of Celluloid. Amyl Acetate or Banana Oil. Precautions for Dipping. Danger from Large Storage.

CHAPTER XL.—Fire Escapes and Exits.

Definitions. Doors and Windows. Division or Fire Wall Escapes. Ropes. Patent Rope Escapes. Flexible Ladder Escapes. Fixed Ladder. Balcony Ecsapes. Balcony and Ladder Escapes. Balcony and Stair Ladder. Balcony and Stairs. Stair Escapes. Tower Escape. Chute Escape. Roof or Goose Neck Ladder. Drop Ladder.

CHAPTER XLI.—Fire Drill.

Safety of Life All Important. Special Conditions in Factories. Value of Safety Measures. What the Fire Drill Does. Traffic Regulation. Tests of Exits and Doorways. Auxiliary to Fire Department. Diversion from Fire Extinguishing Work. Fire Drill and Fire Hazard. Exits Arranged. Collisions Avoided. Quick Dismissal and Ample Exits. Stairway Exit for Each Floor. Stairway as Double Exit. Drilling the Occupants. Distribution of Notices and Warnings. Floor Organization. Fire Fighters, Guard and Searchers. Alarm System. Operation of Drill. Drill Without Signals. Marching in Pairs. Results of Fire Drill.

CHAPTER XLII.—Fire Prevention Inspection of Theatres; What Is Done In New York.

Loss of Life in Theatre Fires. Fire Department System and Inspection. Fire Prevention Requirements for Theatres. Fireproof Construction and Adequate Exits. Electrical Inspection and Certificate. Police License. What the Audience Sees. Fire Wall at Stage. Construction of Proscenium Wall. Protection of Openings. Fire Curtain at Proscenium Arch. How the Curtain Works. What the Curtain Does. Effect of Roof Skylights. Automatic Opening Skylights. Special Fire Department Call. Stage Fire Extinguishers. Automatic Extinguishers on Stage. Theatre Firemen; Their Duties. Theatre Inspectors; Their Duties.

CHAPTER XLIII.—New York Fire Department Rules for Theatre Inspectors.

Asbestos Curtain. Skylights. Fire Alarm. Fire Buckets. Fire Doors. Combustibles and Explosives. Sprinkler System. Standpipe System. Fire Extinguishers. Exit Doors and Passageways. Exit Signs and Lights. Programs. Scenery and Stage Props. Electric Light Wiring. Gas. Fire Hooks. Fire Axes. Heating Arrangement.

CHAPTER XLIV.—Fire Prevention for Schools.

Lessons of the Collinwood Fire. Construction of Building. Start of Fire. Working of the Fire Drill. Congestion at Doorway. Spread of the Flames. Defective Arrangement of Exit Doors. Similar Conditions in Other Schools. Fault in Original Plans. Lack of Inspection.

CHAPTER XLV.—Construction of Schools for Fire Safety.

Cost Objections. Plan and Construction of Vertical Openings. Low Buildings and Small Buildings Recommended. Use of Fire Walls. Location of Exits. Position of Stairways. Elimination of Basement. Isolation of Basement. First Floor Fireproof. Precautions for Fireproof Buildings. Suggestions for Frame Buildings. Fireproofing the Exits. Value of Good Chimneys. Mill Construction Recommended. Partitions as Fire Stops. Fireproofing Wood Floors.

CHAPTER XLVI.—Fire Inspection of Schools.

Inspection and Reports. Fires Preventable. Quarterly Inspections by Competent Person. Self Inspection. Inspectors Recommended. Use of Report Blank. Consideration of Report by School Officials. Suggested Inspection Blank.

CHAPTER XLVII.—Fire Drill in Schools.

The Wrong Impression of Fire Drill. Neglect of Other Safety Measures. Engineering Responsibility on Teachers. How to Consider the Fire Drill. Aimed at Panic. Exit under Excitement. Main Features of Drill. Aids to Marching. Common Questions. Position of Teachers. Which Children Should Lead. Mixed Classes. Importance of Discovering Fire.

CHAPTER XLVIII.—Fire Exits in Schools.

Success of Drill Depends on Exits. Danger of Unprotected Stairways. Close Study of Exits Necessary. Engineering Advice Recommended. Study of Exit Law. Ordinance for School Exits. Definitions. Definition of School Building. Definition of Exits. Number of Exits. Character of Exit Passages. Buildings of Fireproof or First Class Construction. Wire Glass. Stairs. Stair Landings. Hand Rails. Doors.

CHAPTER XLIX.—Fire Extinguishers and Fire Alarms in Schools.

First Thought in School Fires. Fire Drill for All Emergencies. Interior Fire Alarm System. Use for Prompt Dismissals. Number of Alarm Boxes. Prearranged Floor Signals. Direct Alarms. Fire Department Alarm. Direct Telegraph Communication Preferable. Special Alarm Boxes for Schools. Keys for Officials. Supplemental Fire Department Alarm. Independent System. Use of Telephone. First Rule in Case of Fire. Use of Simple Appliances Only. Fire Prevention at Small Cost. Large Fire Prevention Appropriation. Financial Investment and Security. Automatic Alarms. Automatic Sprinklers.

CHAPTER L.—New York Fire Prevention Report for Schools.

CHAPTER—LI.—Fire Prevention for Homes and Residences.

Beware of the Fire Fiend. Fires He Starts. Buildings He Burns. His Work at Night. What the Spark Does. Fire on a Stairs. Fire and the Family. Smoke Is the Fire Messenger. Fires in Theatres and at Picnics. Fires in Hotels and Cities. What Fire Costs.

CHAPTER LII.—What To Do In Case Of Fire.

Fire a Household Trouble. Often Handled by Women. The Fire Card. Send the Alarm. Different Fire Alarm Calls. Fire Alarm Instruction for Family. Two Fire Alarm Calls. Telephone Alarms for Smoke and Chimney Fires. How to Telephone a Fire Call. Using the Street Alarm Box. Methods of Fighting Fire. Smothering the Fire. Shutting Off the Drafts. Warning People. Organizing a Home Fire Brigade.

CHAPTER LIII.—What Is Fire?

Definition. Smoke. Flames. Heat. Draft. Smoke Gases. Fire Light. Why Fire Occurs. Oxygen. Nitrogen. Why Heat Is Produced. Slow Heat and Quick Heat. Rust. When Fire Occurs. What Heat Is. Vibration. How Heat is Produced. Friction. Absorption. Percussion. Pressure. How Heat Is Measured. The Thermometer.

CHAPTER LIV.—How To Put Out a Fire.

Fire Is Tricky and Dangerous. Necessity for Trained Firemen. Fire Extinguishing Hints. Smothering a Fire. Using Water. Spreading of Fire. Use of a Broom and Blanket. Throwing water. Knocking Down a Fire. Handling a Bed Fire. Chimney Fires. Use of Sand, Coal or Salt. Dangers of Chimney Fires. Hidden Fires. Suspicious Smoke. Where Hidden Fires Are Found. Causes of Hidden Fires. How to Discover Hidden Fires. Partition Fires. Tearing Out Plaster. Jumping Fires. Fire Pails. Placing the Fire Pails. Using the Fire Pails. Tank Extinguishers. Syringe Extinguishers. Tube Extinguishers. How to Use Extinguishers. Advantages of Syringe Extinguishers.

CHAPTER LV.—How to Prevent Fire.

Common Causes. Bad Housekeeping. List of Common Causes. Dirt, Dust and Rubbish. Classes of Rubbish. Rubbish Places. Precautions Against Rubbish. Storage in Closets, Cellars and Attics. Oils, Paints, Greases and Fats. Condition, Good Order and Repair. Smoking. Ashes and Cinders. Celluloid. Gas. Gasoline. Benzine and Naphtha. Kerosene Oil. Stoves: Ordinary Cooking and Heating Stoves. Gas Stoves: Low or Flat Stoves. Gas Ranges with Ovens. Stove or Smoke Pipes. Steam Pipes. Matches. Drying Clothes and Laundries.

CHAPTER LVI.—Fires In Wealthy Homes.

CHAPTER LVII.—Bureau of Fire Prevention, New York.

Copies of General Fire Prevention Order. Copy of Affidavit of Service. Copy of Standee Order. Copy of "No Smoking" Order. Copy of "Fire Don'ts." Fire Escape Specifications. Copy of Survey Demand. Copy of Survey Order. Copy of Survey Report.

CHAPTER LVIII.—The Sullivan-Hoey Law Establishing the Bureau of Fire Prevention in New York City.

PREFACE

A FIRE PREVENTION APPEAL.

Edward Atkinson once said: "The only persons who can prevent loss by fire are the owners or occupants of the premises; upon them rests the responsiblity for heavy loss in nearly every fire."

That is the fire problem in a nutshell. It is up to the owners and occupants, who neglect the fire danger.

It is nonsense to talk of modern building laws, of fireproof buildings, or future buildings. The great danger is the old buildings. The way to remove the danger is to make the present buildings safe.

Don't run the risk of financial ruin by a conflagration in this city.

Don't be responsible for a national panic caused by a big fire in this city.

Don't depend on insurance; it never pays for the loss of business.

Remember the Fire Department must have your assistance to fight the conflagration.

Don't ask firemen to risk their lives in dangerous buildings.

You can co-operate with the Fire Department. How?

By making your building safe against fire.

You can prevent fire in your building. How?

By removing the causes of fire.

You can put out fire with small loss and damage. How?

By water pails, chemical extinguishers, standpipes, and automatic sprinklers.

You can discover fire at the start. How?

By automatic fire alarms and watchman service.

You can save time for the Fire Department. How?

By a special building signal that calls the firemen to your building direct.

You can confine the fire to one floor. How?

By enclosing stairways and elevators in brick, tile, concrete, tin-clad wood, and wire glass.

You can help the firemen get at the fire. How?

By having stairs, elevators, and fire escapes accessible.

You can keep out fire from your neighbor's building. How?

By wire glass, fire shutters and outside sprinklers.

You can prevent death or injury to your employees from fire or panic. How?

By having a fire drill in your building.

You can guarantee non-interruption to your business and be independent of the fire insurance companies. How?

By installing Fire Prevention!

FIRE PREVENTION

CHAPTER I.

THE STORY OF HOW FIRE PREVENTION BECAME A SCIENCE.

WHAT is Fire Prevention?

Fire Prevention is the science of making life and property safe against fire.

How did Fire Prevention as a science originate?

Fire Prevention as a science began in the New England mills, and the story of its origin and development is told herewith.

The taking of some precautions against fire is probably as old as the human race. All through history instances can be cited of steps taken to secure safety against fire. In the older and more developed cities and states of Europe it is natural to find the habits and customs of the people considering the fire danger, and building their houses according to some ideas of safety.

It remained for an American, however, to make the Prevention of Fire a matter of classified knowledge, and to apply this knowledge in a manner that represents modern engineering practise. This American was Edward Atkinson, whose fame is widespread, and who is known better for some other things that he did.

Fire Prevention in Amerca goes back to 1835. At that time Zachariah Allen, the owner of a cotton mill at Allendale, R. I., conceived the idea of making his mill safe against fire. He made every building improvement that he could, installed the best fire appliances that he could obtain and took every precaution against fire that he could find out about. When he had got his mill in the best possible condition, he went to the insurance companies and asked for a reduction in his fire insurance rate, because of the improved conditions in his mill.

The insurance gentlemen of that day made an answer that has become historic. They said to Mr. Allen: "A cotton mill is a cotton mill. The rate is 4 per cent. We average them altogether." Mr. Allen's reply has become a little more historic. He simply said: "The cotton mills will insure themselves. We will get the advantage of our improved protection."

This was the beginning of the Factory Mutual System of Fire Insurance, which to-day represents two billion dollars worth of property, insured at a cost of six cents per hundred dollars, about half what it costs to insure an ordinary residence in New York.

One result of the Factory Mutual System was that the ten mills in Lowell, Mass., organized a Fire Protection system, which was orginated by James B. Francis. Francis is known as the father of hydraulic engineering. He was probably the first engineer to treat Fire Protection as an engineering problem, and one of the things he did was to install perforated pipe sprinklers in the Lowell mills.

The Factory Mutual Insurance system had fair success up to 1877, when Edward Atkinson became President of the Boston Company. Mr. Atkinson was a mill owner himself, he had been a director in the Mutual Company since 1865, but he now found himself in a position where he was responsible for the safety of many mills and factories.

The Mutual System had previously been dependent on the memory and judgment of the officers, but several serious fires convinced Atkinson that the Mutual idea would collapse unless the prevention of fire was brought under scientific methods. Atkinson was a business man, without scientific or engineering knowledge, yet he was responsible for the fire conditions of numerous mills and factories. These conditions represented an engineering problem and it is due to Atkinson's perception of this fact that Fire Prevention is now a science and a branch of engineering. He did more than realize the distinction between Fire Insurance, which is simply an actuarial operation, and Fire Prevention which is an engineering function; he made it practical and in doing so was not only the moving spirit and directed the work, devising methods, selecting the men, and educating the mill owners, but he contributed several minor inventions of considerable value.

At the time little or no attention was paid to the causes of fire, the extinguishing appliances were crude and imperfect, there were no rules for the safe construction of buildings, and the care and management of buildings to prevent fire was a minus quantity. To-day there are fire laboratories in London, New York, Chicago, Boston and St. Louis, the available appliances for discovering and extinguishing fire meet all practical needs, the construction of safe buildings is a matter of following established rules, the causes of fire are known, and what is more important, the means of preventing them are at hand, and there are specialists to perform the work. This is the net result of Atkinson's system, designed for mills and factories in particular, it is true, but the same ideas can be applied successfully to all classes of buildings. The half billion fire waste of the United States is not from want of knowledge, but from want of using knowledge.

Atkinson began by finding out what had caused fires in the past, and this was the first time on record that an effort was made to get at the root of the fire evil, the causes of fire. It was found that most of the fires were due to preventable causes, for instance, watchmen's lanterns, gas, rats nests made of matches and oil soaked cotton, lubricating oils, etc. Atkinson found that none of the mills had any way of shutting off the gas in case of fire; he had a valve or shut-off placed outside of every building. The watchmen's lanterns in use were badly made and started many fires by falling apart; he stirred up the manufacturers to get out a safe lantern and this simple matter required five years. Some of the causes needed scientific investigation, so he started an embryo laboratory and got proof of some interesting things that accounted for a lot of mysterious fires. One of the things proved by study and experiment was that rats will gnaw matches and thereby start fires in their nests. This discovery prompted the rule: no hollow construction or concealed spaces in floors, walls or roofs, where rats could build nests.

Another discovery of great importance was that cotton soaked with animal oils will take fire of its own accord, in other words, effect spontaneous combustion. Nothing connected with fire appeals to the average person as this phenomenon and it is difficult of explanation because so few can understand that fire is simply the destructive action of oxygen. The presence of oxygen in the atmosphere means that slow fire is going on all the time, if you increase the oxygen in a combustible material, you get quick fire or flames. Cotton, for instance, is hollow in its structure so that in its ordinary state it is loaded with oxygen almost to the burning point. Add a little heat or touch it with the slightest spark and you get a burst of fire that is so quick because you have touched off a lot of fire gas. Now if you add to cotton already loaded with oxygen some animal oils, also loaded with oxygen, you get an over load of oxygen and the cotton will take fire almost as you watch it.

This is spontaneous combustion and in the New England cotton mills it caused many mysterious fires. The lubricating oils in use helped spontaneous combustion, especially those manufactured by the Standard Oil Company, so Atkinson threatened and fought the company until they stopped selling the dangerous oils and paid a fair price for the business of the only man who was making a safe oil.

After the causes of fire were worked out and the mill owners trained by a system of self inspection to apply the proper remedies, Atkinson's next care was the fires which would occur in spite of every preventive measure. He had applied prevention as far as it would go; he must now take up protection and this meant appliances to discover, extinguish and retard fire. The most important of these proved to be the fire door, the automatic sprinkler and the standpipe and hose and fire pump.

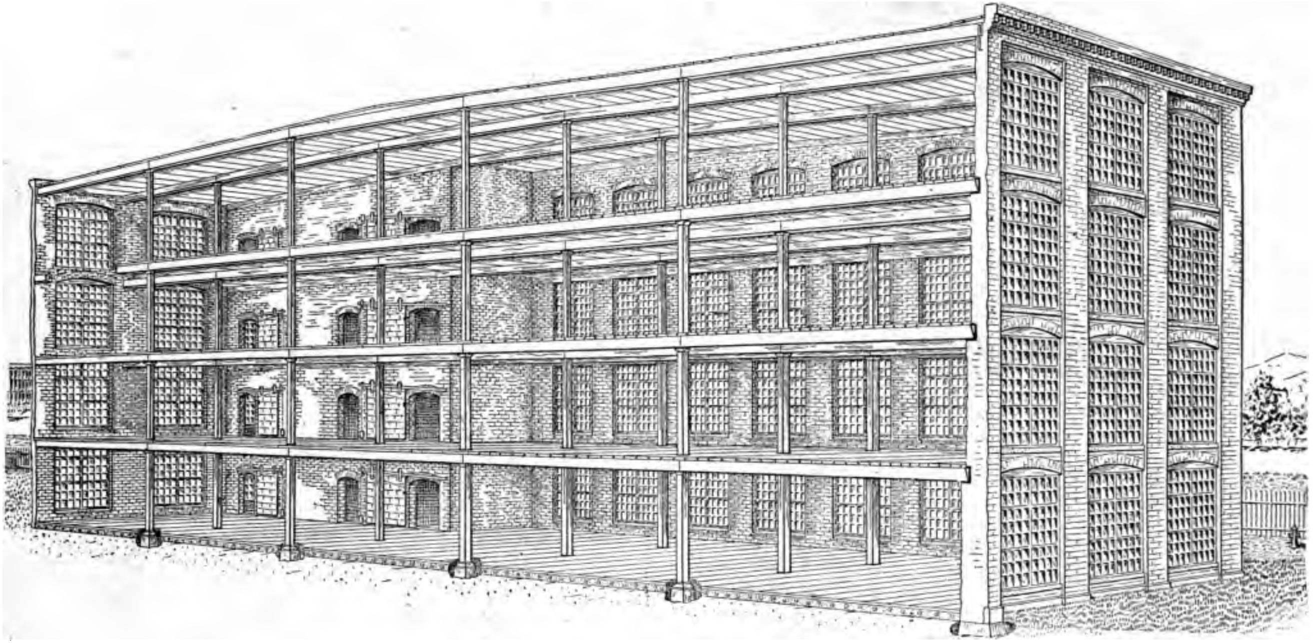
CHAPTER II.

THE INVENTION OF THE FIRE DOOR, THE AUTOMATIC SPRINKLER, THE FIRE PUMP AND MILL CONSTRUCTION.

WHAT was greatly needed was a dependable fire door that would keep a fire from passing into a building by way of doorways that were necessary openings in brick walls. The experience with iron doors, considered the proper thing, because iron would not burn, had been disappointing and costly. The iron got red hot, threw off enough heat to start a fire in the adjoining room, or the door bulged at the corners and let the flames through directly. Strange as it may seem, a wood door covered with roofing tin was found to be a good fire stop. Atkinson took hold of it, drew up rules for properly building the doors, adopted the sliding device invented by Byron Weston and with an automatic closing arrangement invented by himself, gave the world the Underwriter Fire Door. This is still to-day the accepted standard for safeguarding openings in brick walls between two buildings, and next to the automatic sprinkler is the greatest factor in stopping great fires.

Next came the automatic sprinkler, the greatest of all fire inventions, possibly of greater benefit to the world than the fire engine. That a fire should put itself out is the ideal and it has been sought for ages and is still the plaything of every inventive genius who starts thinking about fire danger. The automatic sprinkler fills the bill, because described simply, it is a prepared shower bath turned on the fire by the fire itself. This is accomplished by a water supply fed through pipes laid out in a room just below the ceiling. In these pipes are set the sprinklers, about eight feet apart, the distance that experience has shown, the discharge of water will effectively cover.

The sprinkler which is technically called a "head," is simply a special kind of water faucet. Until the fire sets it working, it is closed air tight and water tight by a valve kept in position by a special piece of metal called a fusible link. This is composed of two parts joined by solder that is melted by heat at 155 degrees Fahrenheit. If you were to plug up your ordinary water faucet with some of this solder, turn on the water and then hold a match or a piece of burning newspaper under the faucet, you would suddenly find the water burst out and drown out the fire. That illus-



A Model Mill Constructed and Slow Burning Building Recommended by Associated Factory Mutual Insurance Companies trates how simply the automatic sprinkler works, and when such a device is placed in factories and workshops, so as to cover every square yard of floor space, it can be realzed what a protection it is against fire starting or getting headway.

Atkinson did not invent the sprinkler, but he shares with Frederick Grinnell, the credit for getting it into general use. Most of Atkinson's associates were skeptical about the sprinkler and some even opposed him in his efforts to get it introduced, one man advising him "When he passed to some other life, to take a sprinkler with him for his own protection." At the time, the only device in use of the kind, was the perforated pipe, a regular sprinkling can affair that had to be turned on by hand, and then it flooded the whole building regardless of how much area the fire really covered.

The automatic sprinkler had been reinvented, to give mention to the numerous historical experimenters, by Thomas J. Parmelee, of Connecticut, and had been placed in some buildings by the company of which Grinnell was the president. The Parmelee Sprinkler after several years experience was found to have serious mechanical defects and in 1877, Grinnell brought out the first sprinkler which was to stand the test of time. The Grinnell Sprinkler used a valve, had a deflector or splash plate to make the shower effect and was discharged by the melting of a fusible link, the three principles on which all modern sprinklers are now constructed. Grinnell did more than invent the sprinkler; he made it his business in more than one sense of the word, to introduce the sprinkler. In the early days, when the sprinkler had to make its way against prejudice and misunderstanding, Atkinson had him present the case of the sprinklers to the cotton manufacturers, and thereafter his whole life was devoted to the development of sprinkler protection. More than any other man, Grinnell is identified with the development of the device and the story of automatic sprinklers is an instance of great benefits rendered to humanity by a great commercial enterprise.

Atkinson was an insistent advocate of sprinklers, because he saw that they were needed to control the increasing fire danger made by large buildings, high speed machinery, and new and dangerous processes of manufacture; Grinnell was the president of the company manufacturing the sprinklers and the underwriter and the business man worked together to get manufacturers to use the much needed protection. As a result of their efforts, the sprinkler came into general use in the New England mills and factories and is now an indispensible feature in nearly all large manufacturing establishments. But for it, certain classes of buildings, the huge department stores, just to mention one example, would not exist, as without the sprinkler's eternal vigilance and protection, the fire danger would be so appalling that public safety would prohibit the erection of such buildings.

If Atkinson was the godfather of automatic sprinklers, he also stood sponsor for what is called Slow Burning or Mill Construction. This is a type of building that has good honest plank or timber in its internal make up; no flimsy packing box members; no hollow floors to hold rat's nests and explosive dust; no sheathed walls to let fire sneak from the cellar to the roof! no pasteboard flooring for fire to eat through. The posts, beams and girders are 12 x 12, the flooring is four inch planks laid right on the big timbers. This is wood construction, it is true, but the wood is so thick and solid that fire cannot burn through, as the outside layer of charred wood "fireproofs" the heart of the timber. There is no instance on record, where fire has burned directly through this plank floor; it will extend through this or any kind of building by way of unenclosed stairways or elevators, but for these vertical openings, the most dangerous feature in any building, Atkinson laid down the rule that they should be in brick towers outside the building proper, so that they could not be a flue to carry the fire up through a building. A true Mill Constructed building is the safest building known to-day, for in spite of the wood in its construction, it has several advantages over the so-called "fireproof" structure.

Another development for which we are in debt to Atkinson is the employment of engineers in fire matters. He was the first man to realize that fire problems called for science and engineering, and that men of technical skill and training should be engaged for the work. This significant fact is not half appreciated to-day, but Atkinson put it in practice more than thirty years ago, and it is due to his judgment and foresight that we have fire engineering as a modern technical profession.

In justice to Mr. Atkinson's associates, and because he himself was unsparing in giving them due praise for their work, their names should be mentioned along with his own. They include the late William B. Whiting, who was the insurance man of the group and the inventor of one of our standard fire prevention appliances, namely, the use of wood covered with lock-jointed tin; C. J. H. Woodbury, the first technically trained man that Mr. Atkinson called in, his chief contribution being the drafting of electrical specifications and specifications for automatic sprinklers, which are almost unchanged to-day; John R. Freeman, an authority on water supply who investigated that subject for fire purposes and, with his associate F. L. Pierce, designed the standard underwriters' fire pump; Joseph P. Gray, an engineer who worked with Mr. Atkinson and is his successor; the late Prof.

John M. Ordway, of the Massachusetts Institute of Technology, who conducted the original fire research; the Hon. Byron Weston, and the late M. M. Tidd.

As a contribution to the world's knowledge, Atkinson's work has been overlooked, because it was done in connection with a special insurance scheme. This was the Factory Mutual System and its eminent success, presented by nearly two billions of property insured at a cost of six and a half cents per hundred dollars of insurance, and also by the fact that during Atkinson's directorate, not a single life was lost by fire in the buildings, is a notable achievement in itself. But the success of this great insurance system was to the development of something of far greater value to the world, an applied science that is a practical demonstration that the fire danger is a controllable one. Thanks to Edward Atkinson and his associates, the prevention of fire, the protection against fire, and indemnity against loss by fire has been made subject to fixed rules and practises. We know the causes of fire and how to remove them; we have devices for discovering and extinguishing such fires as we cannot prevent; we know how to construct our buildings so as to retard fire and barring accidents, which will never disappear from human activities, there is no excuse for destructive fires.

CHAPTER III.

THE NATIONAL FIRE PROTECTION ASSOCIATION AND THE UNDERWRITERS' LABORATORIES.

THE development of Fire Prevention in the Mutual Insurance building was pioneer in its character and its importance cannot be overestimated. But Fire Prevention also developed along other lines which have contributed to place the science in its present position.

The automatic alarm, the watchmen supervision, the wire glass window, the sprinkler supervisory system, fire resistant building materials, metal furniture and a host of similar devices and appliances have been invented or developed in the last forty years, while a number of associations or organizations have also come into being.

One of the most important results was the adoption of Fire Prevention by the regular fire insurance companies, the parent move of this kind being made by the Factory Improvement Committee of the New England Fire Insurance Exchange, in 1885, in which Uberto C. Crosby, E. G. Richards and other prominent Stock Company Underwriters were active participants. Similar committees and organizations were started throughout the country, and after a few years, the need was felt for uniformity in their rules and practices, particularly in respect to automatic sprinkler systems.

As a result, the National Fire Protection Association was organized in 1897, and although started as a Stock Fire Insurance Organization it has since been broadened to include all organizations interested in Fire Prevention. This association through its committees prepared standards, which are published by the National Board of Fire Underwriters and are known as the National Board Standards or the National Fire Protection Association Standards.

The preparation of standards required laboratory investigation, and the Underwriters' Laboratories, Chicago, was established in 1901 for the examination and testing of appliances and devices, and to enter into contracts with the owners and manufacturers of such appliances and devices respecting the recommendation thereof to insurance organizations.

Summaries of the Laboratories' reports are promulgated on printed cards filed according to classifications, and cabinets containing these cards are maintained at the offices of the principal

Boards of Underwriters and Inspection Bureaus in the United States, at many of the general offices of insurance companies, by some insurance firms, certain municipal departments, and at the local offices of the Laboratories in larger cities. Much of the information is also freely distributed by means of lists of approved and permitted devices promulgated by the National Board of Fire Underwriters. The results of the work in many classes of appliances are furnished directly to building owners, architects, users and all other persons interested, by means of the Laboratories' labeling system. The labeling system consists of inspections by Laboratories' engineers of devices and materials at factories and the labeling of standard goods by stamps, transfers or metal labels, whereby they can be recognized wherever found.

CHAPTER IV.

WHAT FIRE PREVENTION IS; ITS STANDARDS AND PRINCIPLES.

FIRE is really a disease; it is caused by unhealthy conditions in a building. These conditions are sometimes organic, that is, part of the building itself; and sometimes functional, that is, part of the operations carried on in a building.

Prevention Neglected.—"An ounce of prevention is worth a pound of cure" with fire as well as any other evil, but not one man in a thousand acts on this principle. With fire, the business man figures he has his insurance; that will cover his financial loss. He depends upon the Fire Department to come and put out his fire. Between the two, he feels satisfied, but his attitude is no more sensible than if he considered his sick benefit sufficient compensation for his personal illness, or waiting until he was on his deathbed, before calling in a doctor.

Why Fire is Preventable.—Taking chances is part of life and business, but some people prefer to take as few chances as possible. To business men who feel this way about the safety and continuance of their business, it is worth while to point out what can be done with the fire danger. Most fires can be prevented; those that cannot, can be discovered and put out with a minimum loss and damage. This is because we know most of the causes of fire and how to remove them and because we have reliable appliances for detecting fires and for putting out fires by manual and automatic means. In a practical way, this means the spending of some money, but money spent this way is an investment. Part of it is returned by a saving in insurance premiums, most of it helps the care and management, what might be called the housekeeping department of a business, and all of it is spent for the improvement of the business itself.

Fire Expert Necessary.—Safeguarding a building against fire is to-day recognized as a distinct branch of engineering, as it calls for the services of a specialist, who is informed about the causes of fire and how to remove them, who understands the planning and construction of buildings and is able to consult with architects and builders, who is familiar with the numerous detecting and extinguishing appliances and who understands what firemen need as an assistance in putting out a fire.

What the Expert Does.—The first Fire Prevention Standard, therefore, is the employment of an expert. He makes a study of the building, applies the principles of Fire Prevention to existing conditions, and in his report, makes specifications for rendering the building safe.

Outside Dangers.—The first step in the work of this specialist is an examination of the building. Its external conditions are considered, to see what dangers it faces from its neighbors and the buildings in the vicinity. The outside danger, exposure, as it is technically called, is met by the use of the wire-glass windows or fire shutters, or some form of water curtain as a necessary protection against fire across the street entering through the windows. The roof is also considered and the skylights protected against fire brands dropping through the glass and starting fires within the building.

Causes of Fire.—Inside the building, what are called the hazards, that is, the probable causes of fire, are examined and dangerous conditions corrected. These hazards exist in the heat, light and power apparatus, in the accumulation of rubbish and the storage of unused articles and in the general cleanliness and care of the building. These fire causes are found in all buildings, but in the case of trades or industries, there are always special fire causes as part of the business which require special attention. These, however, can be removed or so safeguarded as to practically remove the danger of fire starting.

The Safe Building.—The second standard is the standard of safe construction. The building is the locus of the problem of saftey and as such it is truly the ground work of the solution. It is easier to say that a building shall be safe than it is to have people grasp the principles of safety. Safety is not to be found in any one type of structure or in the use of any one kind of material. The truth of this is perhaps better realized to-day, as a result of the many disasterous fires in the so-called fireproof buildings. The Washington Place fire with its toll of 145 lives occurred in a fireproof building and a fireproof building that was indeed better than the average. It is in fact the type of building that many people have been demanding for years as a requisite for fire safety and many of the newly proposd remedies call for a similar building.

It is therefore to be hoped that this fire among other benefits may forever kill the belief that safety lies in any type of building or any form of construction. It is not the kind of materials that counts so much as the use that is made of them. Incombustible materials or fireproof materials are valuable and an assistance as far as they go, but they can be so used as to create danger by providing a sense of false security. The buildings of the Factory

Mutual System for example, are not fireproof in the common acceptance of the term. They have wooden floors and wooden structural members, but in spite of this supposedly inflammable construction, they are the safest buildings of their class in the world. Many of the Factory Mutual Buildings, in fact, are built entirely of wood, but even those buildings are far safer than the overrated fireproof buildings.

The secret of safe construction is the design and the use of materials to prevent the starting of fire and its rapid spread. Mr. Atkinson and his associates laid down the rule that wood used in factory construction should be plank and solid timber, so that there were no flimsy packing box pieces arranged to feed the flames or permit fire to burn through a floor as if it were made of pasteboard and cheese cloth. They also laid down the rule that all stairways, elevators and other openings through the floors should be enclosed and barred to the fire so that it could not use them as a passageway from one floor to another.

Improving Present Buildings.—Present buildings, regardless of what use is made of them, are always capable of improvement and, in most cases, at a moderate expenditure. It is not necessary to rebuild nor to have a "fireproof" building, although the latter is always preferable. In existing buildings the chief danger lies in the shafts or openings through the floors, such as stairways, elevators, belt holes, pipe channels, ventilating shafts, etc. These vertical openings are responsible for fire spreading rapidly throughout a building and getting beyond the control of the firemen. They can be enclosed or stopped off in a variety of ways, so it is practicable to prevent them acting as fire carriers.

CHAPTER V.

FIRE APPLIANCES AND THEIR USES.

THE Need of Appliances.—It has been said that the building is the locus of the fire and its importance could, therefore, not be overestimated. However, great a factor as it may be, it is not the only factor, and consideration of it alone, does not secure safety. Fire is a phenomenon that for efficient control requires prompt discovery, the prompt application of extinguishing measures and the provision of retarding or confining measures.

The third standard of safety, therefore, is the equipment of a building with fire appliances. These appliances are mechanical devices which are self operating in many cases, or mechanical devices to be used by occupants.

Fire Detectives.—Warding off a fire is the first and best thing to do, but in spite of every precaution, fire will occur and the sensible thing to do is to be ready for it. The first step is to provide means for detecting it.

For the discovery of fire, there is available automatic fire alarms or detectors, which are self operated by the heat of the fire, and which ring alarms or give signals to the Fire Department or the persons in charge of the building. The use of these thermostats, as the automatic fire alarms are technically called, is supplemented by the employment of watchmen or fire patrols who regularly patrol a building and are required to visit every part of the premises during each hour.

These watchmen are in fact, simply human fire alarms and joined to the necessity of caring for property during nights, Sundays and holidays, makes them indispensable for buildings of any value. Being human, they are expected to fail in their duties more or less, so that a system of control has been established for them. The movements of these fire watchmen are recorded by means of watchmen's time detectors, of which there are three types in use. One is the portable watch clock, which the watchman carries with him, and in which he makes records of his movements. Another is the stationary watch clock which is located in the office or some other place and the watchman makes records upon it by means of electrical connections, placed throughout the premises that he is expected to patrol. The third is the central office system, which maintains telegraph connection with buildings in which the watchman is employed. To this central office, the watchman transmits signals according to a regular schedule of time and place, and if his signals do not arrive at the appointed time, the central office dispatches a runner or roundsman, to find out why the watchman did not report as required.

The automatic fire alarm and the watchman are considered fire detectors especially, but there is another appliance which performs this service as well as its own particular service, the automatic extinguishing of fire.

Supplementing the watchman as a fire detector in the automatic alarm, which is either a fire sensitive wire, which can be run all over the building, or a similar device, called a thermostat, which is placed at intervals on the ceilings. These operate when heated to a certain degree and give a signal, either in the building or to an outside office, which notifies the fire department.

Interior Alarm.—On the discovery of a fire an alarm should immediately be given, not only through the building but also to the fire department. To do this properly there should be put in an interior alarm system, whereby a central point, such as the office, or the superintendent's or engineer's quarters, can be promptly notified that there is a fire on such and such a floor, and then announce it on all floors by means of gongs.

Fire Department Call.—A special building signal to Fire Department Headquarters is a necessary part of a good alarm system, as this saves the time required to run to the street box and is also an auxiliary alarm in case the public alarm system is out of order.

Fire Pails.—"First send in the alarm, then put out the fire," is the one best rule to follow. It has been said that every fire could have been put out with a pail of water. This is an exaggeration, but it is true that more fires are put out with pails of water than by any other means.

A pail of water was undoubtedly the first fire extinguisher and it is even to-day the extinguisher most generally used. The fire pail is cheap. It can be installed anywhere and its use is understood by practically everyone. Fire pails are, of course, objectionable on artistic grounds, so to overcome this, there are manufactured what are called bucket tanks. These are simply metal tanks or barrels of water, in which are placed six or seven pails; in case of fire the cover of a tank is raised and pails of water are drawn out of the tank. Bucket tanks are used in hotels, department stores and office buildings where the ordinary pails are considered unsightly.

Next to fire pails, the most common form of hand fire appliance is the chemical extinguisher. This is a copper tank with a small hose attached for the purpose of directing the stream of water. The tank holds about two and a half gallons of water in which has been placed some bi-carbonate of soda. A small bottle of sulphuric acid is suspended within the tank with a loose stopper, so that when the extinguisher is turned upside down, the sulphuric acid is mixed with the soda solution and the chemical reaction produces carbonic acid gas. This gas is an extinguishing agent in itself and when carried along with the stream of water helps to extinguish the fire, but its principle purpose is not as an extinguishing agent, but to put the water in the extinguisher under pressure so that the stream can be thrown to some distance.

The advantages of these carbonic acid gas extinguishers over pails of water are several, particularly that the water can be thrown to a great distance and directed better, while the larger quantity of water makes the extinguisher a more powerful and dependable appliance. There are also other small fire extinguishers; hand grenades which are glass bottles of chemical solutions to be thrown at the fire; dry powder extinguishers, which are metal tubes containing bi-carbonate of soda, or other material, which forms a gas when heated by the fire, and a new type of extinguisher in the form of a syringe or hand pump. This contains a liquid, which forms an extinguishing gas when brought in contact with the flames and is useful in fighting the class of fires, for which water is ineffective.

Pails of water and standard chemical extinguishers are the fire-fighting apparatus which can be used by everyone (although a little practice in using them is advisable) and they should be found in every building in the land.

The Fire Standpipe.—Hose lines attached to a constant water supply—what is usually called a standpipe system—are also installed in many buildings. A standpipe to most people means a high vertical tank to hold the water supply of villages and towns. A fire standpipe, however, is simply a line of pipe to supply water to hose connections at various points along the pipe. The water is supplied either from a tank, firepump, or by the Fire Department apparatus. The standpipe is usually vertical, as this appliance is a special feature of high buildings. The purpose of the standpipe is to do away with the necessity of firemen stretching long lines of hose; it is thus applicable in buildings of great area as well as those of extreme height. Eighty-five feet or six stories is supposed to be the necessary height for a standpipe equipment, but it is just as useful in a building of only fifty feet or three stories high.

The use of hose streams in putting out a fire is essentially the work of practical firemen. It is true that in mills and factories with automatic sprinkler protection, the employees use hose successfully. This is due to working under cover of the sprinklers. In exposure fires, that is, fires in buildings across the street, fire hose can also be used successfully, as well as in some cases of interior fires, but the expense of most practical firemen shows that the necessity for hose streams means that the fire cannot be handled by untrained men. The practical fireman is not only trained in stretching hose lines and handling pipes and nozzles discharging water under pressure, but he is used to standing the smoke and heat, "taking punishment" as firemen call it. He has confidence enough to approach close to the fire, and from his experience he knows when it is safe and when it is not. The ordinary person trying to put out a fire with a hose line directs the stream of water at the smoke instead of at the fire proper, and once the water strikes the fire, the cloud of steam that arises drives off many who were able to withstand the smoke alone.

If fire cannot be extinguished by fire pails or chemical extinguishers, it is in all probability too large and too dangerous to be attacked by others than trained firemen, so that if a fire is extensive enough to require the use of hose streams, it had better be left for the attention of a regular fire department. This recommendation it qualified to some extent, where automatic sprinkler systems are installed because the sprinklers generally hold the fire in check and made it safe and advantageous for the occupants to use hose streams. In other situations were trained firemen are not available, the use of fire hose is, of course, desirable, but proper instruction should be given to the men who are to use it.

Automatic Sprinklers.—The use of so many manual appliances, the maintenance of extensive and costly fire departments and the occurrence of numerous and wide-spread fires (conflagrations, as they are popularly called) would seem to indicate that automatic fire extinction was a minus quantity. The very opposite is the case, however. It is especially fortunate that there is available an effective and reliable fire extinguisher, which is not dependent for its action upon any human act, but depends on fire itself generating sufficient heat. Sufficient heat in this case means simply 155 degrees Fahrenheit, which is very little above the temperature of Turkish baths. The automatic fire extinguisher is so sensitive and responds so quickly that it is operated by holding a match underneath the appliance.

Automatic fire extinguishers are technically called sprinklers because the prototype was a perforated pipe, which discharged water much as a sprinkling cart does. In the development of automatic fire extinguishing, the perforated pipe was displaced by an appliance which is really a special type of water faucet made to screw into piping. It is made of bronzed metal and in shape resembles a seal ring. It consists of a square or circular plate in which is a half-inch hole, through which the water discharges. From the plate extend two arms which hold a deflector or splash plate directly opposite the water opening. The water opening is closed with a piece of metal or porcelain, called a valve, held in place by a stiffener or strut, which is fastened between the valve and the joint of the two arms. The strut is composed of two or more parts held together by fusible solder, which melts at a fixed temperature, usually 155 degrees Fahrenheit. Once heat is applied to the sprinkler, the solder melts and the strut falls apart. This allows the valve to fall out of the water opening and the water comes out. As the water is under pressure, either by gravity fall or from a pressure tank, it comes out with some force. As it issues from the opening, it is a solid stream, but when it strikes the deflector or splash plate it is broken into drops or spray and falls as a dome or cone shaped shower.

One sprinkler will wet from 80 to 100 square feet of ceiling and floor space and put out a fire not only by the chemical action of water on the fire, but also by blanketing the fire with the fine spray; that is, by shutting off from the fire the supply of oxygen, without which there is no fire.

Sprinklers, or heads, as they are technically called, are set into pipes which are hung just below the ceilings of the floors. These horizontal pipes vary in size from one inch to several inches, depending upon the number of heads on each line of pipe, and they are connected to large vertical pipes, called risers. The risers are the main feed or supply pipes for the ceiling pipes and they are connected to the sources of water supply. These sources are either tanks, a fire pump, the public water works system, or the Fire Department steamers or engines. The tanks contain from from 5,000 to 25.000 gallons of water and are considered only the temporary supply to put into action the automatic features of these sprinklers. If the fire is extensive or requires considerable water, it is expected that the permanent water supply will come from one or more of the other sources, as they are considered practically inexhaustible, at least for fire purposes.

The sprinkler is not only an automatic fire extinguisher, but it is arranged to give notice as soon as it starts working. Attached to the main supply line, usually close to the tank outlet, is an alarm valve. This is a mechanical or electrical device, which is operated by the flowing of the water through it. The water in the sprinkler pipes is still until a sprinkler head opens; then the water begins to move and the alarm valves give an alarm signal either in the building or to an outside office. It is thus a fire alarm as well as a notice that the sprinklers are working, and this feature provides for the contingency that the sprinklers might open and discharge water for hours without anyone knowing the fact.

CHAPTER VI.

CONFINING AND RETARDING FIRE.

FIRE Stops and Fire Walls.—After fire appliances have been used as far as practicable, an additional safeguard is available in the form of confining or retarding appliances. These appliances are particularly fire doors and fire shutters or fire windows. As they are elements of construction, they may be considered under the operation of the second standard of safe construction. In the progressive steps of handling the emergency of fire, they really come into play after the fire appliances have been used, on the theory that if a fire cannot be effectively extinguished, then efforts should be made to confine or retard it.

Fire doors are placed at doorways or other openings in brick walls, which divide a building in sections, or which separate one building from another. A brick wall is the best fire stop yet invented, but if it contains openings by which fire can pass through, it is of little use as a fire stop. Such openings are necessary for the ordinary transaction of business, yet they offer the grave danger of a fire in one building getting into another building and thereby doubling or trebling the size of the fire. For this reason, one of the earliest steps in the working out of Fire Prevention was to devise a door, whch should not only be fire resistant in its materials and construction, but should also be arranged to close by itself in case of fire.

Iron doors had originally been used for this purpose on the presumption that iron being non-combustible, would successfully resist fire. The presumption was an error, however, because the problem is to stop not only flames but heat, and the iron door signally failed to do this. The iron became red hot and thereby transmitted great heat, while the door bulged and warped at the corners, thereby permitting free entrance for sparks and flames. In the search for a better fire door, the idea was taken of using wood boards covered with tin applied with lap seams and lock jointed in the same way that the tinsmith applies tin to a roof in order to make it water tight. This combination of wood and tin proved highly successful, and is still to-day the construction of the standard fire door adopted by all insurance organizations.

The discovery of suitable materials was one step. The next step was to secure easy closing, and this was done by the invention of the sliding door, which was arranged to be hung on overhead tracks with rollers to make it easy to slide back and forth. The advantages of a sliding door over a swinging door for quick and easy closing is apparent. The swinging door requires mechanical force, either springs or weights to close it, while the sliding door when placed upon an inclined track requires simply that it be released, when the force of gravity forces it to close. The third step in the development of the fire door was an automatic release that would cause it to close when the fire occurred. This automatic release was invented by Mr. Atkinson, who used a lever arrangement, held in place by a piece of fusible metal. Fusible alloys such as Mr. Atkinson used were invented by Sir Isaac Newton, but Mr. Atkinson used this principle to make a fusible link. This consists of two pieces held together by solder which is melted by the heat of the fire, thereby breaking the link, and this in turn released the lever, valve or other mechanism held in place by the link.

Fire Windows.—The perfection of the fire door provided for the problem of openings in the interior walls of a building or in parting or dividing walls between two buildings. There remained the problem of protecting openings in the exterior walls of buildings, such as windows, in order to stop a fire from a neighboring or adjoining building extending to other buildings. This danger is technically called the exposure danger and represents the outside fire danger or the danger that a building faces on account of fire in its neighboring buildings or in the surrounding locality.

Window openings have been protected against fire by the use of shutters, which were originally made of iron and later of tin clad wood, following its successful use in the construction of fire doors. Fire shutters have been generally installed on the outside of buildings, but they are sometimes placed on the inside walls, particularly since the development of rolling or sliding iron shutters.

The great development of window protection for fire purposes, however, has been made possible, through the invention and manufacture of wire glass. This consists of a sheet of glass with a wire mesh embodied within the glass. It was originally designed to prevent the breakage of glass from ordinary blows or shocks, because its operation is such that when a sheet is broken or cracked the pieces of glass are held in place by the wire mesh, so that the sheet of glass continues to fulfill its ordinary purposes.

Its use for Fire Protection purposes was really an after thought, but it is to-day more widely used as a fire retardant than for its original purposes as non-breakable glass. It is extensively used in skylights and other exposed places where natural illumination is desired, but where the presence of glass offers an entrance for fire. It has made possible ideal protection for window openings, because it can be fitted into window sashes and window frames of regulation construction. Thus the window opening is protected against fire by the same construction installed for ordinary building purposes, instead of using a special construction, such as shutters, which are also usually objectionable for artistic reasons.

Fire windows in which the glass is wire glass have the frames and sashes made of incombustible materials, such as copper, galvanized iron, metal covered wood, or asbestos composition. They are also manufactured in the usual type of windows, that is, sliding, swinging or pivoted windows. The use of a pivot window has made it possible to produce an automatic fire window which can be left open at will, yet will be closed if a fire occurs within a building or is trying to enter from the outside. The automatic fire window is designed to hang on a pivot above the centre, so that when released, the greater weight of the lower half of the window causes it to swing shut. It is held open by a chain, in which is set one or more fusible links, of the character used for closing fire doors and opening sprinkler heads, so that the melting of one of these links causes the window to shut of its own operation.

Fire Walls.—The fire door and the fire window are the two principle devices for confining or retarding the spread of fire, but it is also a practice to install fire stops in the shape of walls or partitions which either subdivide a large area into a smaller and safer space, or confine a particular dangerous process or operation to a single room or a reduced section of the building. Such fire stops are really elements of safe construction and are usually installed when the building is planned and erected, but they are frequently installed in older buildings, which were originally erected with little or no regard for fire safety.

CHAPTER VII.

THE TREATMENT OF FIRE CAUSES AND THE LIFE HAZARD.

THE prevention of fire as a particular and special function means the removal of all known causes of fire, or if there are present certain causes which cannot be removed bodily, then the safeguarding of these, so that their liability of producing or originating a fire is reduced to a minimum. While it is true that there has never been an adequate study of the causes of fire on a truly philosophical and scientific basis, it is a fact, none the less, that most if not all the common causes of fire are perfectly well known. In addition, the causes of fire that we do know are so numerous that it is not difficult to find a plausible, and in fact, an acceptable cause for nearly all of our fires. Of course, it is not possible, and in fact, why should it be necessary to find the particular cause of every particular fire, when we know of so many causes that could readily be responsible for it. As a matter of fact, if we should take care of the common every day causes of fire, half the battle would be won. The fire expert performs his most tangible and self evident service in removing causes. He can examine a building and point out very definitely, conditions that mean the starting of fire sooner or later and he can follow up this fire diagnosis by prescribing a course of treatment.

The Causes of Fire.—The statement of the standards of safety has been made according to the order in which they would come into play in the case of a new building, that is to say, it is presumed that the fire expert would be called in to pass upon the original plans and specifications, to advise the selection of materials and their use as well as to indicate the necessary equipment of fire appliances. A particular step that should be taken when the building is planned and erected, is the proper installation of heating, lighting and power apparatus as well as precautions or safeguards of other inherent fire dangers, which may be part of the use and occupancy for which the building is designed. A proper consideration for precautions and safeguards is therefore the fourth standard of safety. While this standard is placed fourth numerically, it is really first in importance, because it is a simple proposition that, if a fire can be successfully prevented, that is the logical thing to do. It is working along the line of resistance, for it reduces or obviates the necessity for subsequent measures.

The Human Factor.—The standards so far described have dealt with the construction of the building, the machinery or processes of operation and the use of appliances or systems. These would suffice if our building was uninhabitated, but as it is to contain people to a greater or less extent, there is presented the human factor.

Fire is an uncertain thing and it produces excitement and fear. The presence of smoke sets people into a panic even if there is no danger from the heat and the flames. It is not only girls and women that lose their heads when a fire occurs, but men as well, and even trained firemen are not proof against panic. Anyone who has ever witnessed or experienced a fire scare is ready to testify to the value and necessity of a prearranged system of procedure and the adoption of fixed rules of action, so that when fire occurs things go forward in an orderly and systematic manner.

Employes and occupants, for that matter, require some form of fire drill. It should be made a regular practice to go through the routine of sounding a fire alarm and have everybody in the building accustomed to a fixed form of action, so that when fire actually occurs some intelligent effort is made to handle the emergency. A fire drill is absolutely necessary in all buildings containing a large number of persons, such as factories, stores, hotels, asylums, hospitals, schools and other institutions, but the equivalent of a fire drill, that is, a knowledge of what to do in case of fire, is advisable for even private buildings. How to summon the Fire Department, for instance, is not known to the majority of householders, and this along with other simple rules should be taught to all the members of a family.

The method of handling a fire emergency is sometimes called a fire drill and this indeed is stated to be the fifth standard of safety. A fire drill as installed in school buildings and many other places is usually only a system of marching and seldom meets the full requirements of the situation. The fire drill to fulfill its purpose should provide for all the accidents and contingencies that are part of a fire. In its plan, it should include provisions for sounding a warning or signal to all persons in the building. It should provide for the forming of the people into ranks and the marching of the ranks under leadership to the exits. It should provide for sufficient safe exits to discharge the people within a safe period of time. It should assign to competent persons the duty of using the fire appliances, both in extinguishing or checking the fire and in notifying the Fire Department and co-operating with the firemen when they arrive. In brief, it should assign to every person in the building a fixed duty and leave nothing to chance or haphazard.

It follows from this statement of the purpose and function of a fire drill that it should be installed by a fire expert, because it is only the expert who can anticipate the starting of a fire, indicate its probable extension and provide for the unusual conditions that are bound to arise. It is positively an increase of danger to have so-called fire drills, which are merely a system of marching people out of the building, because such drills are parades rather than practice in discharging people from a building on fire. There was a pathetic demonstration of this fact at the school fire in Collinwood, Ohio, in 1908, when 163 children were led down a stairway into an open hallway where the fire leaped upon them. The fire drill worked perfectly as far as the marching of the pupils went, but the person who planned this drill had no conception of the fire dangers of this particular school building and therefore did not realize the terrible mistake of having the children use a stairway that was open to the flames and smoke.

Inspection and Maintenance.—The sixth standard of safety is regular inspection. It is a matter of common experience in all branches of human activity that a well designed and well built machine is of reduced value if provision is not made for keeping it in effective working order. The principle of maintenance is just as necessary in dealing with the problem of fire as it is with anything else. Eternal vigilance is the price of safety as well as liberty, and a factory or any other building that is to be made safe and continued in that desirable state must be carefully looked after.

Fire inspection to be thoroughly effective, should be both self inspection and super-inspection. The owner of a building and the employer of labor should be sufficiently informed about the fundamental requirements of safety to be able to personally assure themselves that they are being observed. The actual work of examining the fire appliances and the precautions and safeguards may be delegated to an agent or a subordinate, provided some degree of personal supervision is exercised. This can be done by the use of a detailed fire inspection report or blank, which covers questions and answers on the practical examination and tests made by the subordinate.

Self inspection is valuable and necessary as a proof that the occupants of the building are themselves concerned about the fire danger, and are personally taking some steps to provide for their own safety. It is human nature, however, to relax care and vigilance through constant familiarity. For this reason it has been found as a matter of experience that super-inspection by an outside and disinterested agency is essential. The super-inspector, as he might be termed, visits the building at unexpected times; he comes to the building with his perceptions fresh and keen, so that he is in a position to notice defects and errors that are overlooked by persons in daily contact with the conditions.

CHAPTER VIII.

THE BUREAU OF FIRE PREVENTION LAW AND WHAT IT MEANS.

THE Law. The Bureau of Fire Prevention in New York City was established by the Sullivan-Hoey Law, passed by the legislature in 1911. This law changed sections 727 and 728 of the Greater New York Charter and added eleven new sections. The entire Hoey act will be found at the end of this book. A digest of these changes is as follows:

New Bureau.—Section 727 was changed to give the Fire Commissioner control of all the bureaus of the department and to create a new bureau called, the Bureau of Fire Prevention. The Commissioner is to direct this bureau, and its business is to carry out all Fire Prevention Laws which the Commissioner may be required by any law or ordinance to enforce. The head of the bureau is to be known as the Chief of the Bureau of Fire Prevention; he is appointed by the Commissioner, who also appoints other officials and subordinates as may be necessary.

Control of Uniformed Force.—Section 728 gives the Fire Commissioner sole power over the uniformed force and takes away from the Fire Chief, the control formerly exercised by the Chief of Department.

New Sections.—Eleven new sections are added to the Fire Department Chapter of the Greater New York Charter and their meaning is as follows:

Fire Prevention Duties of Commissioner.—Section 774 requires the Fire Commissioner to enforce all laws and ordinances treating of the Prevention of Fires, combustibles and explosives, fire alarms and fire extinguishers, fire exits, origin of fires and cases of arson.

Fire Prevention Powers of Commissioner.—Section 775 gives the Fire Commissioner specific powers as follows:

1. To make inspection anywhere by means of an officer or employe.
2. To issue a written order to remedy any dangerous fire condition, except in tenement houses.
3. To issue a written order for fire alarms or fire extinguishers or fire exits, according to law or ordinance.
4. To have a dangerous building or other place vacated or removed.

5. To move a vessel on fire, in danger of fire, or otherwise dangerous to a safe place in the harbor.
6. To enforce his orders or department orders.

Right of Entry.—Section 775 also gives any officer or employee of the Fire Department, the right to enter buildings or other places and make inspections.

Service of Orders.—Section 775 also permits Fire Department orders to be made out to cover the premises without naming the owners, lessees or occupants. This is intended to make it easy to serve orders, because by this section all that is necessary in the order is the correct address or location of the building, while the names of the persons can be omitted. Orders may be served by delivering a copy to owners or lessees or to the person in charge of the building, or by posting a copy of the order upon the premises.

Fire Hazards are Nuisances.—Section 776 makes any building or other places which are dangerous on account of fire a nuisance. The purpose of this section is to make it easier to remedy fire conditions, because if they are declared nuisances, it is easier to attack them as the Penal Law gives broad powers in dealing with nuisances.

In Case of Compliance with Order.—Section 776 also permits the Fire Commissioner to fix a time for compliance with the order, and the parties who receive the order must do the work as quickly as possible.

In Case of Refusal.—Section 776 also gives the Fire Department power to execute its order in case the responsible parties refuse or neglect to do so, unless the responsible parties demand a Survey. The Commissioner cannot supply fire alarms, fire extinguishers or fire escapes, but he can have the building or other place vacated until the orders are complied with.

Liability for Costs.—Section 776a makes the expense of executing an order under section 776 a personal charge against the responsible parties and also a lien on the rent of the building.

Appeal from Commissioner's Order and Making of a Survey.—Section 777 gives the responsible parties the right to appeal from the Commissioner's order and the steps to be taken are as follows:

1. Written demand for a Survey.
2. Demand served on Commissioner, Deputy Commissioner or member of uniformed force.
3. Demand made within forty-eight hours after order is received, Sundays and holidays excluded.
4. Demand sent to Fire Commissioner.

5. Fire Commissioner orders survey and names three surveyors.
6. Surveyors are to be (1) officer or employe of the Bureau of Fire Prevention, or member of Municipal Explosives Commission; (2) architect or builder of ten years' experience; (3) person from list furnished by New York Board of Fire Underwriters, or if they do not furnish a list, from list furnished by Commissioner with approval of the Mayor.
7. Fire Commissioner's orders for Survey to contain date and hour of Survey.
8. Person demanding Survey to be furnished with copy of order 24 hours in advance.
9. Person demanding Survey has right to be present and to be heard.
10. Copies of order may be served according to section 775.

Action of Surveyors.—Section 776a gives the steps to be taken by the surveyors as follows:

1. Surveyors meet at the time and place given in the order.
2. They examine the building and pass upon the merits of the order.
3. They sign a report of their action and decision.
4. Their report is filed in Fire Department.
5. A copy is given to the parties demanding Survey, if they ask for it.

Court Proceedings.—Section 777a gives the court proceedings on the surveyors' report as follows:

1. Surveyors report is final, except for review by Supreme Court.
2. Review by Supreme Court is by certiorari.
3. Application for review by certiorari to be made within four days after surveyors' report is filed.
4. Order made by Supreme Court on Survey cannot be appealed.

Payment of Surveyors.—Section 777b allows surveyors twenty-five dollars each, to be paid out of the contingent fund of the Fire Department, after they have filed their report. Surveyors who are officers or employes of Fire Department are not to be paid.

Reimbursement of City.—Section 777b allows the city to be repaid for all expenses of the Survey if the Commissioner's order is upheld.

Deposit for Survey.—Section 777b allows the Fire Commissioner to require a deposit of $100 when Survey is demanded. This deposit is to make good to the city, the expense of the Survey if the Fire Department wins. If the Fire Department loses, the money is returned to the depositor. Without such a deposit, a demand for a Survey is not binding.

City Can Sue for Reimbursement.—Section 777b gives the city the right to collect the expense of a Survey from an owner and can have a lien upon the property as fixed by section 776a.

Commissioner Can Vacate Buildings.—Section 778 gives the Fire Commissioner power to vacate a building in the following way:

1. If a Fire Department order is not complied with.
2. If the Commissioner certifies in writing that an emergency exists.
3. The order to vacate shall be served as fixed by section 775.
4. If order to vacate is not complied with, Commissioner can apply to Supreme Court.
5. Order of Supreme Court directs Commissioner to vacate such building.
6. Order of Supreme Court prohibits all use of the building until order is complied with.

Duty to Transmit Notices.—Section 778a requires all persons served with orders or notices to notify the owner or agent immediately, if within the City of New York and residence known. If without the City of New York, a copy of the order or notice is to be mailed prepaid. Failure to do this makes the person served, personally liable to the owner for damages.

Commissioner's Duty to Investigate Fires.—Section 778b requires the Fire Commissioner to investigate fires, for which he can use a Chief of Fire Prevention, a fire marshal, assistant fire marshal or other department officer who has power to give oaths and take testimony. Investigation governs the origin of fires, cases of arson, incendiarism or fire due to criminal carelessness.

Investigating Officer has Power of Subpoena and Oath.—Testimony and report of investigating officer is filed in the Fire Department. Fire Commissioner may furnish copies to the New York Board of Fire Underwriters, owners or other interested persons. In case of criminal fires, Commissioner or officer authorized by him, shall co-operate with Police Department and District Attorney and furnish them with copies of testimony and reports. Evidence and address of witnesses are to be reported to District Attorney without delay.

Municipal Explosives Commission, Continued.—Section 778c continues the Commission and makes its regulations a city ordinance, when approved by the Fire Commissioner.

CHAPTER IX.

FIRE PREVENTION SECTIONS OF GREATER NEW YORK CHARTER.

CARE of Shavings.—Section 760 requires carpenters or others having shavings, to safeguard them from fire under a penalty of $5.00.

Street Fires.—Section 760 provides a penalty of $10.00 for making a street fire except under regulations of the Fire Commissioner.

Chimney Fires.—Section 760 provides a penalty of $5.00 for a fire in a chimney, stove pipe or flue.

Closing Doors and Shutters.—Section 761 provides a penalty of $50.00 for failing to close trap doors and fire shutters and to cover hoistways and well holes.

Injuries to Firemen.—Section 761 makes the person who fails to cover hoistways, well holes and trap doors liable for injuries to members of Fire Department in the sum of $1,000 in case of injury and $5,000 in case of death.

Responsibility for Fires.—Section 761 makes the persons responsible for fires due to negligence, liable for damage to person or property. Also for cost of Fire Department operations, to be fixed by Commissioner and paid into Pension Fund. Also liable for injuries or death of members of department at the fire.

Protection for Lights.—Section 762 requires gas lights to be protected by globes, glass coverings or as the Fire Commissioner shall direct.

Alarm Systems.—Section 762 requires all buildings containing large numbers of persons to have alarm systems connected to Police and Fire Department for fire danger as directed by the Fire Commissioner or Police Commissioner.

Fire Appliances.—Section 762 requires all such buildings as above stated to have fire appliances as directed by the Fire Commissioner.

Watchmen.—Section 762 requires hotels, lodging houses, hospitals or asylums to have watchmen to patrol the building, discover fire and give warning as directed by the Fire Commissioner. Watchmen are to have time detectors to record their movements.

Exit Signs.—Section 762 requires in above buildings diagrams in every room and exit signs in the halls and passageways.

Interior Fire Alarm.—Section 762 requires above buildings to have bells or gongs to sound fire alarms throughout building.

Care of Fire Appliances.—Section 762 requires that fire appliances in above buildings, and fire exits, be kept in good working order.

Fire Department Inspection.—Section 762 allows any member of uniformed force to enter above buildings and inspect fire appliances.

Firemen at Theatres.—Section 762 allows the Fire Commissioner to detail one or two members of uniformed force to amusement places having machinery and scenery when open to the public.

Duties of Theatre Firemen.—Section 762 provides the following duties for theatre firemen:

1. To guard against fire.
2. To take charge of fire appliances.
3. To direct employees in case of fire.
4. To inspect every part of the building.
5. To notify manager or employee of standees or obstructions in aisle.
6. To have obstruction removed forthwith.
7. To have aisles cleared.

Violation and Penalties.—Section 762 makes it a violation with penalty for theatre employees to have obstruction or refuse to remove them after being notified. See new Standee Regulation on a later page.

Watchmen in Theatres.—Section 762 requires one or more watchmen in amusement places, except fireproof buildings.

Explosives Commission.—Section 763 provides for the Board of Aldermen to establish a Municipal Explosives Commission.

Members.—The Commission consists of five members:

1. Fire Commissioner as chairman.
2. Three members appointed by Mayor.
3. One member appointed by Mayor from list of ten submitted by New York section of American Chemical Society.

Regulations.—The Commission is to adopt regulations to be approved by the Mayor and published by Fire Commissioner in the City Record.

Meetings.—Commission meets at the call of the Fire Commissioner and members are paid $10.00 for each meeting. A majority is a quorum.

License for Explosives.—The use or handling of explosives requires license from Fire Commissioner under regulations of the Commission. Fire Commissioner can revoke license.

Employees.—Employees who handle explosives must hold certificate of fitness from Fire Commissioner under regulations of Municipal Explosives Commission.

No Manufacturing of Explosives.—Explosives prohibited by Municipal Explosives Commission cannot be manufactured in the city.

Bonds.—Holders of license must file a bond of $1,000 to $5,000 with Fire Commissioner and approved by Comptroller. Bonds are to pay damages and to guarantee observance of regulations.

Municipal Explosives Commission by unanimous vote and approval of Fire Commissioner can increase bonds to $25,000.

Violation and Penalty.—A violation of the Explosives Regulations, even though no damage be done, costs a forfeit of the bond, twenty per cent. for first offense and the entire bond for second offense, money to go to the Pension Fund.

Explosives on Ships.—Ships with more than twenty-eight pounds of explosives are required to notify Fire Commissioner before they approach within 300 yards of pier line, also to carry at the mast head, a red flag five feet square. Also not to lie at a pier after sunset without a permit from Fire Commissioner for not more than forty-eight hours.

War Vessels Excepted.—United States war vessels or foreign war vessels are not made subject to these regulations if 300 yards away from pier line.

Criminal Liability for Deaths.—Section 767 makes it a felony for selling an explosive contrary to law, in case death is caused, the penalty is a fine of not less than $1,000 nor more than $5,000, or imprisonment for not less than one year nor more than five years. In case of bodily injury the injured party can sue for damages.

Fraudulent Oil Samples.—Section 767 provides a fine of $50.00 if a dealer offers for sanitary survey a fraudulent sample of oil.

Illegal Privilege in Insurance Policy.—Section 767 provides a fine of $500, if a fire insurance company gives permission in its policy for combustibles or explosives contrary to law.

Right of Entry.—Section 771 gives the Fire Commissioner and his assistants the right to enter all buildings containing combustible materials to discover violations of law.

Notice of Violations.—Section 771 also gives the Fire Commissioner power to issue written or printed orders to correct defective or dangerous conditions within a stated time.

Penalty.—Section 771 also provides a penalty for refusing to obey the Commissioner's order. The fine is $25.00 and $5.00 for every additional day's neglect.

Costs on Owner of Building.—Section 772 also puts the cost of guarding dangerous conditions upon the owner of the building, but the occupant pays first and deducts from the rent, unless there is a special argument otherwise.

Information for Permits.—Section 772 requires all applicants for permits to furnish necessary information in advance.

Penalties and Liabilities.—Section 773 provides penalties for violation of this title of the Charter. If not specially provided the fine is $50.00 with liability for costs or expenses. A fine of $50.00 is also provided for failing to comply with the Commissioner's order or to answer a subpœna.

Payment to Informers.—Section 773 also allows the Commissioner to pay one-half of the fine to the person who informs about the violation.

Suits.—Section 773 provides that all suits shall be brought by and in the name of the Fire Commissioner, but no fees or costs shall be demanded.

Violation is a Misdemeanor.—Section 773 also makes it a misdemeanor not to comply with any provision under this title or order made according to this title of the Charter.

CHAPTER X.

AUXILIARY FIRE APPLIANCES.

AUXILIARY Fire Appliances can be defined as extinguishing appliances placed in buildings for the use of the Fire Department, but the term is also used more broadly to include certain appliances intended to assist the occupants in case of fire.

A list of Auxiliary Fire Appliances covered by Fire Department Regulations are as follows:

Fire Pails
Chemical Extinguishers
Standpipe System.
Automatic Sprinklers
Sprinkler Supervisory Service
Perforated Pipe Sprinklers
Watchman Service
Telegraph Communication
Interior Alarms
Fire Axes
Fire Hooks
Rope Fire Escapes
Signs in Halls
Diagrams in Rooms

CHAPTER XI.

FIRE PAIL EQUIPMENTS.

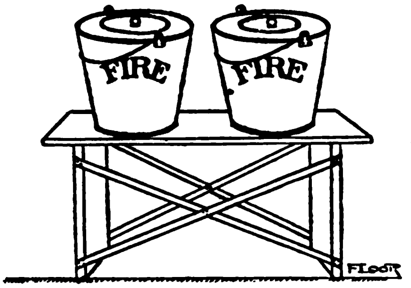
FIRE Pails.—A pail of water is the best fire extinguisher yet invented. It costs little; its use is understood by everyone; it is easily kept ready for use; and its effect, if used at the proper moment, may be better than the work of an entire fire department five minutes later. The value of fire pails has come to be recognized, not only by the insurance community and by practical firemen, but also by all other persons having a care for the safety of life and property. Accordingly, it is a common practice for property owners, of their own accord, to have pails of water ready, in case of fire; in addition, the officers of local fire departments use their authority to bring this about, and fire insurance organizations have not been lacking in encouraging the insuring public to equip their premises with this simple means of fire protection.

Fire Pails are useful only when they are filled, within easy reach, and near at hand; and in order to accomplish this, a set of rules have been made up regarding Fire Pails. These rules are the result of more than fifty years experience with the public who frequently install costly fire protection equipments, and then take no steps toward keeping them in condition for use when fire occurs.

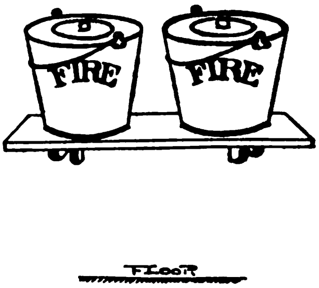
Manufacture. Fire Pails should be made of galvanized iron and painted red with the words FIRE, or FOR FIRE ONLY, in black letters not less than two and one-half inches high. Flat Bottom Pails are the best. Round Bottom Pails are used in places where employees are likely to use them for other purposes, but in case of fire, they cannot be handled easily because they cannot be set down. Wooden Pails should not be recommended or approved.

Size. A ten quart size is the best because it can be handled most easily, but the twelve quart size is acceptable. Pails over twelve quarts should not be recommended.

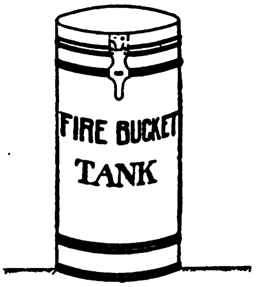
Setting. Fire Pails should have a setting that is fixed, permanent and used only for Fire Pails. Shelves, brackets, hooks or benches are the proper setting for Fire Pails, but they should be intended for the pails and not used for other purposes. Fire Pails placed as follows should not be approved:



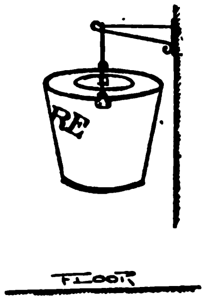
BENCH OR STAND
Lowest, 2 feet to bottom of pails
Highest, 5 feet to top of pails



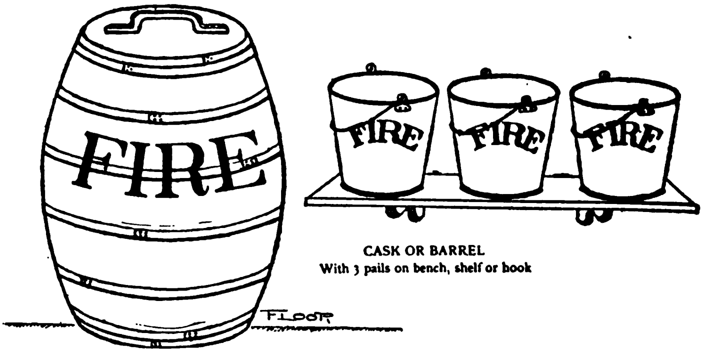
SHELF
Lowest, 2 feet to bottom of pails
Highest, 5 feet to top of pails



BUCKET TANK
Containing 6 pails immersed in water



HOOK OR BRACKET
Lowest, 2 feet to bottom of pail
Highest, 5 feet to top of pail



CASK OR BARREL
With 3 pails on bench, shelf or hook

Methods of Installing Fire Pails Recommended by
New York Fire Insurance Exchange

On the floor
On stock shelves
On window sills
On radiators
On top of one another or in tiers
On safes
On desks
On boxes
On or under work tables or benches

When round bottom pails are set in shelves or benches, the holes cut out for the pails should be only large enough to receive the oval bottom; that is, the flange of the bottom should rest on the wood and not be set into the opening.

Height. Fire Pails should not be set less than two feet above the floor, measurements being taken from the floor to the bottom of the pail. The reason for this rule is that when pails are too low they get covered up and hidden, or they get knocked over and are not taken care of. They should also not be set higher than five feet above the floor, measuring from the floor to the top of the pail. The reason for this rule is that if pails are set higher than five feet, they cannot be reached easily or taken down when needed.

Distribution. Fire Pails should be distributed so that they will be near at hand in every part of a building. An extra number of pails should be placed near dangerous rooms, machinery or other things that are most likely to start a fire. A good rule for distributing pails is to divide them in sets of 2, 3, 4, 5, or 6. It is not recommended to have more than six pails in one set. Examples of this distribution are as follows:

If there are twelve pails or less on a floor, divide them in sets of two or three.

If there are twenty-four pails or less on a floor, divide them in sets of 2, 3, or 4.

If there are more than twenty-four pails on a floor, divide them in sets of 4, 5, or 6.

In placing sets of Fire Pails, it is well, if possible, to put them diagonally opposite, that is, "criss crossed" or staggered, as this may reduce the distance to be traveled when a Fire Pail is wanted.

Location. Fire Pails should be placed as near as possible according to the following rules:

Place them in a clear space where they can be reached quickly and easily.

Place them near exits, such as, stairways, elevators, fire escapes and doorways, so that the person who uses the pails can reach them without having to pass the fire and can also make his escape if he cannot put out the fire.

Place them in a familiar spot where they will always be seen by the occupants.

Place them near places where fire is most likely to start.

Do not place them where they will be blocked by stock, machinery or fixtures, or get covered with rubbish or other material.

Filling. Fire Pails should be refilled once a week regularly with clean water.

Sand Pails. Where oils, paints or inflammable liquids are kept, used or stored, one-half of the total number of Fire Pails required should be kept filled with clean dry sand. It is well to provide a scoop for use in throwing the sand. Sand Pails should not be filled too full, as it makes them too heavy; two-thirds full is sufficient.

Freezing. When Fire Pails are placed where the water is likely to freeze in cold weather some salt or chloride of calcium should be placed in each pail. Chloride of calcium gives better results than the salt. It is not expensive, and is sold in drums weighing about 600 pounds, costing about one cent per pound. It will not corrode metal tanks, and, therefore, is better in every way than salt, which is so detrimental to iron and eats off metal hoops sometimes in six months. The proper proportions to use are given in table below the plus sign showing degrees above zero and the minus sign degrees below zero, which may be withstood by the several percentages of calcium chloride added to the water:

Calcium Chloride to each gallon.	Freezing point Fahrenheit.	Calcium Chloride to each gallon.	Freezing point Fahrenheit.
½ pound	+29	2½ pounds	+10
1 pound	+27	3 pounds	Zero
1¼ pounds	+25	3½ pounds	— 8
1½ pounds	+23	4 pounds	—17
1¾ pounds	+21	4½ pounds	—27
2 pounds	+18	5 pounds	—39
2¼ pounds	+14	5½ pounds	—45

Person in Charge. The Fire Pails should be placed in charge of the engineer, the janitor, the foreman, the watchman or somebody who will be responsible and make it his personal business to see that the pails are properly kept.

Substitution. In place of the regular Fire Pails, the following may be used:

Chemical Extinguishers
Patent Bucket Tanks
Casks of Water
Gas Extinguishers

If Chemical Extinguishers are used instead of Pails, it is well to let them take the place of only one-half the required number of pails, counting one extinguisher as being equal to six pails, or one cask and three pails. There should always be some pails on every floor.

If Patent Bucket Tanks are used, they can be counted as equal to the same number of pails that they hold, usually six pails in each tank. Bucket Tanks should be tested once a week to make sure that the covers can be lifted easily and the pails drawn out without trouble.

If Casks of Water are used in the place of pails, each cask can be counted as equal to six pails under the following conditions:

The Cask should be a good oak barrel and hold not less than fifty gallons of water. It should be painted red with the words, "FIRE," or, "FOR FIRE ONLY," in black letters not less than six inches high, and should have a cover with a handle. Three Fire Pails should be placed on a shelf or hooks near the casks.

CHAPTER XII.

CHEMICAL EXTINGUISHERS, THEIR CONSTRUCTION, INSTALLATION AND USE.

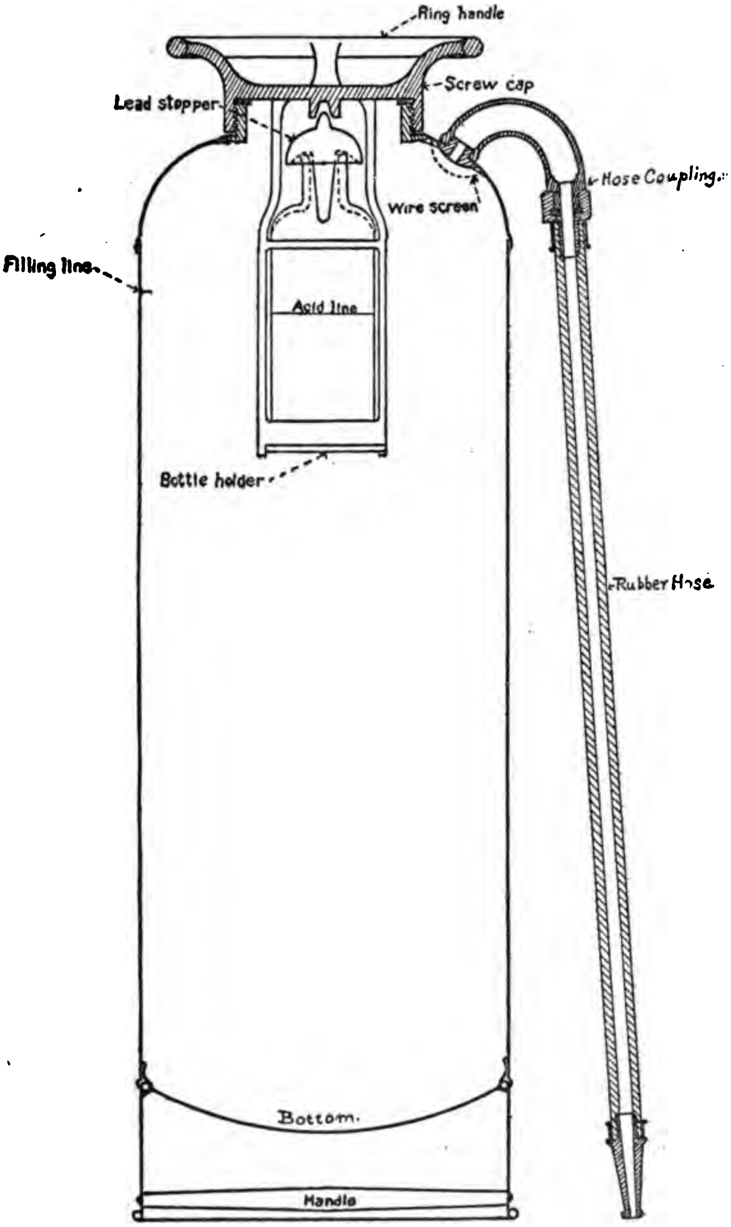
CHEMICAL Fire Extinguishers.—In the effort to provide handy means of fire extinction other than pails of water, numerous devices have been produced depending on the use of chemicals. Most of these have proved unsatisfactory in actual practice, but the device known as the chemical fire extinguisher, which uses carbonic acid gas and water, has been perfected to an extent which makes it a valuable fire appliance for use by the general public.

This device is a cylindrical copper tank with a small hose attached, and when charged weighs about thirty-five pounds. It is filled with water in which is dissolved some bi-carbonate of soda, while in a glass container, kept separate from the soda solution, is some sulphuric acid. When the acid and the soda solution are mingled carbonic acid gas is formed, creating considerable pressure and propelling the water through the hose with great force.

In addition, the carbonic acid gas is a non-supporter of combustion, and when carried along with the water helps to extinguish the fire, a result to which the sodium salts in the solution also contribute.

Years of experience with carbonic acid gas devices demonstrates beyond question that when these are intended for use by inexperienced persons, three requirements are very necessary. First, that the machine shall operate by simply turning it upside down; second, that the acid shall be fed gradually; and third, that the machine shall withstand the pressures generated with a large margin of safety. Poorly constructed machines, or a defective or complicated method of combining the acid and the soda solution are liable to render the extinguisher worthless at a time when every dependence is placed on it. For this reason it becomes necessary, not only in the interest of the fire insurance community, but of the insuring public as well, to establish a standard of safety and reliability.

The standard of the National Fire Protection Association as published by the National Board of Fire Underwriters requires the use of good materials, proper shop practice in manufacture, the protection of interior parts against corrosion, the



Sectional View of a Chemical Fire Extinguisher use of a slow acid feed method, the operation of the extinguisher by inverting it and the absence of valve or stops in the outlet.

The shell of the extinguisher tank is required to be hard copper of sufficient thickness, and put together in a manner, to withstand the test pressure of 350 pounds to the square inch, with a sufficient margin between this test point and the bursting point. Its durability is provided by requiring that the entire interior and all parts exposed to the action of the chemicals shall be coated with lead.

The mixing of the acid with the soda solution is required to depend solely on upsetting the extinguisher, at the same time gradually feeding the acid instead of emptying the entire supply at once. This is accomplished by placing the acid in an ordinary bottle set in a cage or other support, with a loose lead stopper in the mouth of the bottle. When the extinguisher is upset, the lead stopper falls away from the bottle, but is so arranged that it acts as a throttle, thus limiting the flow of acid and providing an automatic regular feed, thereby removing the danger from high pressures suddenly generated by mixing all the acid at once.

For convenience in replacing the bottle if broken, the use of an ordinary prescription bottle is obligatory, while the bottle holder is arranged to permit the ready removal of the bottle for refilling, for which purpose a filling line is marked on the bottle.

The hose is to be of such strength and attached in a manner, to withstand a test pressure of 350 pounds to the square inch, easily removed and replaced, and with a lead nozzle having a smooth bore outlet of 1-8 to 3-16 of an inch without any shut-off stop. For ready handling, handles are provided at the top and bottom, while the screw cap of the extinguisher has a permanent ring handle, making it possible to unscrew the top even when badly struck. The following directions for the use and recharging of the machine are plainly marked on the side of the shell, while a heavy paper or linen tag is provided for keeping a record of its maintenance:

FOR FIRE TURN UPSIDE DOWN.

Directions for Charging.

Dissolve 1½ lbs. of Bi-Carbonate of Soda in 2½ Gals. of water and pour into extinguisher to filling mark on inside. Put 4 fluid ounces of Sulphuric Acid in 8-ounce bottle, put lead stopper in bottle and insert bottle in holder. Screw cap on securely.

Discharge and recharge once a year and record date on card attached.

Clean thoroughly whenever used.

Protect from frost.

Extinguishers constructed according to these specifications are tested by the Underwriters' Laboratories, Chicago, Illinois, before being listed as an approved device. A number of machines submitted by the manufacturers are tested on the basis of new machines and this original test is repeated with machines taken at random from field service. These tests comprise open and closed nozzle tests, inverting tests, acid discharge tests, hydrostatic tests and shop practice tests.

When extinguishers have successfully withstood the tests they are published on the list of approved devices on condition that the manufacturer expressly agrees to construct all such machines in strict accordance with the specifications on file with the Underwriters' Laboratories and to submit for yearly examinations machines selected from any stock offered for sale.

Careful tests and skillful workmanship, however, are not all that is necessary; neither the specifications nor the manufacturer can guarantee efficiency if the appliance does not subsequently receive proper attention, and this is the duty of the purchaser. The care of fire appliances is a necessary safeguard to life and property and as such is one of the most important features in the administration of any business or household. In the case of fire extinguishers, it is especially necessary because of the composition of the device, which, however, requires only slight attention, that being to recharge it within a year, with a small quantity of materials which can be purchased at any drug store, and the operation being so simple that almost any person can perform it.

With all the good points of extinguishers, it must still be said that they have not the simplicity and dependableness of pails of water, and accordingly, it seems the part of wisdom not to permit them to entirely replace fire pails. This opinion is practically unanimous among all who are charged with the duty of fire protection and consequently a general rule has been made that the fire appliance equipment must always include some fire pails, and therefore, not more than one-half of the required number of pails should be replaced by fire extinguishers.

A—Shelves, brackets or hooks are the approved setting, but they must be intended for, and limited in their use to, extinguishers. If hooks are used, the extinguisher must be supported at the bottom as well as at the top. Extinguishers placed as follows, should not be approved:

On the floor
On the stock shelves
On desks
On radiators

On window sills	On boxes
On safes	On work tables

B—To be not lower than two feet above the floor, measured from the floor to the BOTTOM of the extinguisher.

C—To be not higher than five feet above the floor, measured from the floor to the TOP of the extinguisher.

In placing extinguishers, it is very necessary that they be placed near exits, such as stairways, elevators and fire escapes (preferably in the stairway hall or enclosure), in order that in case of fire, the person who uses them may do so from a place of safety and with means of escape provided. After the exits have been covered, other extinguishers may be distributed at central points in the space they are intended to protect, preference being given to points in close proximity to places where fire is likely to start, and to familiar places within constant sight of the occupants. In all cases they must be in a clear space, providing free and unimpeded access and must not be blocked by stock or machinery, or covered with rubbish or other materials.

Extinguishers should be tested and examined at least once, and preferably twice a year, frequent tests being invaluable in the knowledge they give employes and other persons of the operation of the device. At these tests the extinguisher should be discharged as if for actual service, and then examined for corrosion of the interior or other defects. After the tests, or whenever used, the extinguisher should be cleaned and recharged. To recharge an extinguisher, the cap should be unscrewed, the acid bottle removed and any remaining contents emptied from the tank and the bottle. Then the tank and the bottle should be thoroughly rinsed with fresh water and any deposit removed from the wire screen over the hose outlet.

The soda charge is prepared by mixing one pound and a half of bi-carbonate of soda in two and one-half gallons of water and stirring until the soda is dissolved, when the solution can be poured in the tank, care being taken that it does not rise above the filling mark indicated on the inside of the tank.

The acid charge consists of 4 fluid ounces of commercial sulphuric acid (oil of vitriol), which, when poured in the bottle, should not rise above the filling mark indicated on the bottle. If the bottle has no filling mark the acid should fill not more than half the bottle.

When the lead stopper has been put in the bottle, it can be replaced in the bottle holder and the latter put in position in the tank. In replacing the cap, the washer must not be omitted; the cap should be screwed down tight and cross threading avoided. After recharging, the date and the signature of the person who performed it should be recorded on the card or tag attached to the machine for that purpose.

Extinguishers should not be exposed to a temperature of 32 degrees Fahrenheit or lower.

Extinguishers should be carried to the fire right end up, and to be used, should be tipped upside down. This action automatically starts the stream, which can be shut off by righting the extinguisher. If the extinguisher fails to work at once, or the stream has not sufficient force, a vigorous shaking will usually remedy the matter. While the stream is more effective if used close to the fire, in case of necessity it can be directed from a distance as great as 25 feet. The stream should always be directed first at the lowest part of a fire and then worked upward. The use of the extinguisher is especially recommended for the following kinds of fires:

> Inaccessible fires in hidden places, between floors, ceilings, and partitions, and in chimneys, flues and shafts.
>
> In enclosed spaces, such as closets, boxes, etc.
>
> Overhead fires, such as draperies, curtains, hangings, decorations, etc.

The extinguishers must be placed in charge of the engineer, the janitor, the foreman, the watchman, or some person with authority, who will be answerable for their efficiency.

CHAPTER XIII.

THE FIRE LINE OR STANDPIPE.

STANDPIPE and Hose System.—A Standpipe and Hose System is a mechanical fire extinguishing system, whose purpose is to carry water to the upper floors of a building and thereby save the stretching of hose. It is chiefly an aid or an auxiliary appliance to help the Public Fire Department, but is sometimes intended to be used by the occupants.

Principal Parts. Piping, Fire Engine Connection, Valves, Hose, Nozzles, Water Supplies.

Piping. The piping is the distributing part of a Standpipe System, that is, it carries the water from the source of supply to the hose connections. The principle parts of the piping are the Risers, the Cross-connections, the Branches and the Filling Pipe.

Risers. These are the main supply pipes and run from top to bottom of the Standpipe System. They are connected to the water supplies, such as, Tanks, Pumps, Street Mains or Fire Engines. The Riser should be placed close to stairways, and if the stairway is inclosed in a shaft or hall, the Risers should be within the inclosure. The reason for this is to help the firemen reach the hose connections on each floor when they come up the stairs and also to protect the hose from being burnt by the fire.

Branches. These are large pipes which connect the Riser with the water supply, and usually run in a horizontal direction in the basement or at the top floor. At each floor smaller pipes are taken off the Riser to make connections for the hose.

Cross-Connections. These are large horizontal pipes, which connect one Riser with another Riser, so that if water is distributed into one Riser, it can flow across into the other Risers and thereby make good circulation of water, which will help to supply the entire system. Cross-connections are required to be made in the basement or lower level of the system.

Sizes of Piping. These vary according to the size of the Standpipe System and the height of the Risers. The New York Fire Department rules, which are made partly according to the Building Code and partly by the Department Officials, are briefly as follows:

Buildings less than 150 feet high, require four inch Riser.
Buildings over 150 feet high, require six inch Riser.

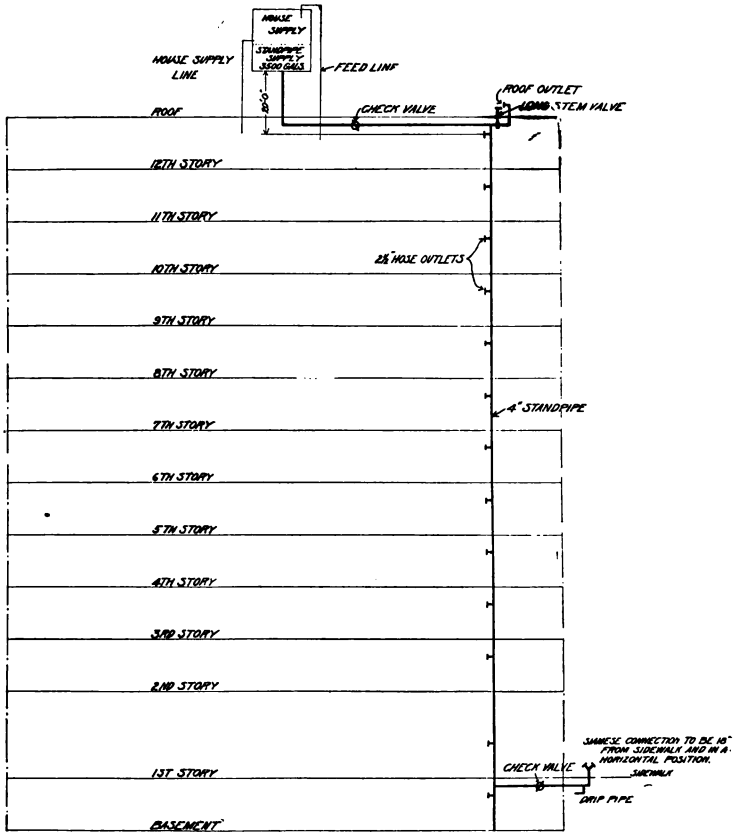


Diagram of Single Riser Standpipe System

Drawn by J. W. Story, Bureau of Fire Prevention, N. Y. F. D.

Fire Engine Connection. The Fire Engine Connection to a Standpipe System is a hose connection at the street level and through which the Fire Department supplies water to the Standpipe from a fire engine or from high pressure hydrants.

Siamese Connection. If the connection has two couplings or inlets it is called a Siamese Connection, which simply means that it is a double connection and has two branches or two ways by which water may be pumped into the Standpipe. If the connection has only one coupling it is called a single connection or, one-way.

Standard Connection. Only double or Siamese Connections are standard and approved by the Fire Department. In Manhattan and the Bronx, the size of the couplings are three inches, in Brooklyn, Queens and Richmond, the size of the couplings are two and one-half inches, in order to fit the size of the hose that is used.

Female Couplings. All Fire Engine Connections to Standpipe Systems are required to have couplings with inside threads, what is called a Female Coupling, in order to properly receive the hose coupling which has outside threads.

Position. Fire Engine Connections are required to be set with the hose couplings not lower than eighteen inches above the sidewalk and should not be set higher than three feet above the sidewalk. They should also be set in a clear space and unobstructed, so that they can be reached easily in order to connect the hose. The position of the hose couplings is to be straight out or horizontal, and not to point down or up, as this makes it more difficult to connect hose.

Check Valves. Each branch of the Siamese Connection is required to have a Check Valve in it to hold back the water from the coupling for that branch, so that if water is already being pumped into one branch, hose can be connected to the other branch without interference from the water flowing out.

Caps. All couplings for Fire Engine Connections should have Caps, and these should be oiled and cleaned regularly, so that they can be moved quickly at the time of a fire. These Caps screw into the couplings the same as a hose coupling. On the outside of the Caps are two projections or knobs, which are called lugs; these are to receive the spanner wrench, which is used to unscrew the Caps.

Valves. Valves are mechanical constructions placed in Standpipe Systems, whose purpose is to control the flow of water. The kinds of Valves used in Standpipe Systems are:

Check Valves, which are used to prevent water flowing in the wrong direction or beyond a desired point.

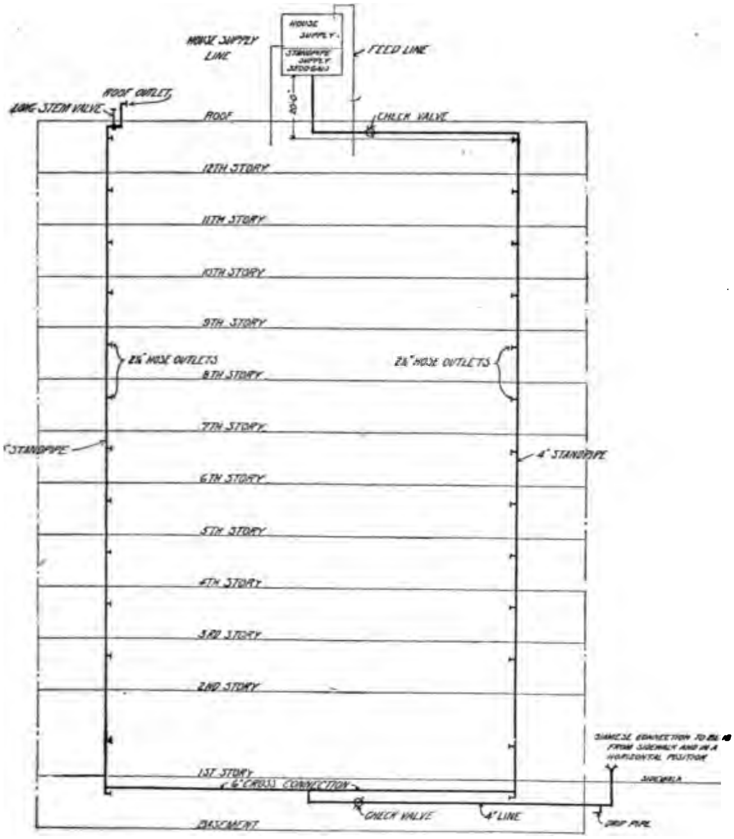


Diagram of Two-Riser Standpipe System Showing Cross Connection Line

Drawn by J. W. Story, Bureau of Fire Prevention, N. Y. F. D.

Gate Valves, which are used to shut off the water, or stop it flowing beyond a desired point.

Hose Valves, which are placed at the hose connections, and are used to let water flow from the Standpipe into the hose.

Pressure Reducing Valves, which are used in the Standpipes of very high buildings to reduce the pressure to a safe point.

Check Valves. Check Valves are constructed to allow water to flow only in one direction, this being accomplished by having the valve hinged so that it will swing open in one direction and swing closed in the other direction. Check Valves are placed in the Standpipe Systems at the following points:

Fire Engine Connection with a Check Valve for each coupling, with Check swung towards the Riser and away from the coupling.

Feed Branch, with the Check swung towards the Riser and away from the Fire Engine Connection.

Tank, with Check swung towards the Riser and away from Tank.

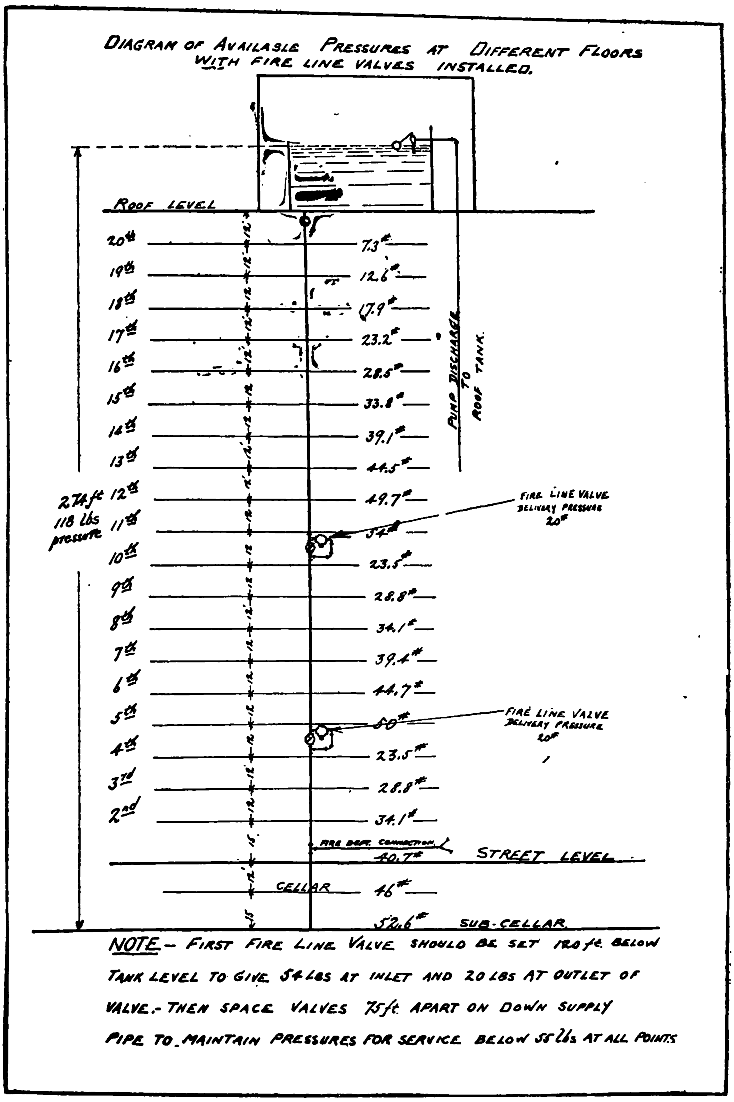
Pump. with Check swung towards the Riser and away from Pump.

Gate Valves. Gate Valves are constructed to permit water to flow or shut it off as desired. They are not permitted in Standpipe Systems, between the Fire Engine Connection and the Risers, but may be placed at the Tanks or the Pumps. The reason for this is, that no obstruction should be allowed in a Standpipe System, which will prevent the Fire Department pumping water into it at the time of a fire. Gate Valves at a Tank or Pump are necessary in order to shut off the water from these sources of supply in case it is necessary to make repairs.

Hose Valves. Hose Valves are of the type of Gate Valves. They are placed in Standpipe Systems where the hose is connected to the Riser, usually on every floor and roof of the building.

Pressure Reducing Valves. Pressure Reducing Valves are placed in the Standpipe Systems of very high buildings, to reduce the pressure which the water has after falling from a tank at great height. In the case of buildings over 120 feet high, and especially in tower buildings, such as the Metropolitan, Singer and Woolworth towers, the water from the ordinary tanks would have such force at the lower floors that it could not safely be handled by firemen. For this reason, Pressure Reducing Valves are installed which automatically reduce the pressure to a safe limit.

Hose. On each floor of a building and sometimes at several places on a floor, valves and connections are placed in the standpipe system to which hose can be attached. The hose is in fifty



NOTE— FIRST FIRE LINE VALVE SHOULD BE SET 120 ft. BELOW TANK LEVEL TO GIVE 54 LBS AT INLET AND 20 LBS AT OUTLET OF VALVE.- THEN SPACE VALVES 75 ft. APART ON DOWN SUPPLY PIPE TO MAINTAIN PRESSURES FOR SERVICE BELOW 55 lbs AT ALL POINTS

Diagram Showing Reduction of Pressures on Standpipe by Use of Pressure Reducing Valve foot lengths coupled together, and enough of it is provided so that every part of the floor can be reached by a stream of water. The hose used for standpipe systems is an inch and one-half or two and one-half inches, either unlined linen hose, or rubber lined hose similar to what the Fire Department uses. Hose is kept wound on a reel, folded in boxes or hung on racks or brackets.

Nozzles. At the end of a length of hose there is attached a nozzle or play pipe, which is used to concentrate the water into a smaller stream and thereby gain increased pressure, as well as to direct the stream of water to advantage. Nozzles or play pipes are of two varieties, open and shut-off. The open nozzle has no means of shutting off the water and the valve at the end of the hose connection must be used. This is the nozzle generally installed in buildings. The shut-off nozzle has a controlling valve, and is the nozzle usually used by firemen.

Water Supplies. The water supplies for standpipe systems are usually those used for automatic sprinkler systems, which are described in the section on automatic sprinklers. Gravity Tanks and the Fire Department apparatus are the most common water supplies for standpipe systems, but in some cases Pressure Tanks and Fire Pumps are also used.

CHAPTER XIV.

A STANDPIPE SYSTEM FOR A SKYSCRAPER.

MODEL Forty-two Story Fire Standpipe.—A fire protection system for a building of forty-two stories or 576 feet high is decidedly a novel and unique proposition. It means providing water for fire extinction purposes and the necessary mechanical aids, at a height never before required, and to accomplish this in a practical and useful way required very careful consideration of the capacities of the standpipe or fire line as an auxiliary appliance for fire department use. As a result of conferences between the architect of the Singer Tower, Ernest Flagg, and the Chief of Battalion in charge of the Bureau of Violations and Auxiliary Appliances, New York Fire Department, the system installed in the tower has been approved by the Fire Department. The plan and specifications of the system are published herewith.

WATER PIPING FOR FIRE SERVICE SINGER BUILDING ADDITION

TANKS.

1. 42d floor, one 3,000 gallon tank.
2. 39th floor, one 7,000 gallon tank.
3. 27th floor, one 5,000 gallon tank.
4. 13th mezzanine floor, three 2,000 gallon tanks connected.

RISERS.

1. One 4-inch riser from 42d floor tank, going down to 38th floor, with 3 hose connections. This riser is connected to 6-inch riser from 39th floor tank.
2. One 6-inch riser from 39th floor tank, going down as far as 26th floor, with 12 hose connections. This riser is connected to 6-inch riser from 27th floor tank.
3. One 6-inch riser from 27th floor tank, going down as far as 13th floor, with 16 hose connections. This riser is connected to 6-inch riser from 13th mezzanine floor tanks.
4. Two 6-inch risers from 13th mezzanine floor tanks going down to street, with 14 hose connections on each.
5. One 4-inch riser running up through ground floor, and 1st and 2d floors with 3 hose connection with pressure of 13th mezzanine floor tanks, and street connection.

FIRE DEPARTMENT AND HOUSE PUMP CONNECTIONS.

1. Fire engines to pump into all risers by means of two 3-inch Siamese connections on street.
2. Pumps to pump into all risers.
3. Pumps to pump into all tanks, and tanks to supply risers from above.

CHECK VALVE SYSTEM.

1. A check valve placed just beneath each tank, open downward. This does not allow engines or pumps to pump into tanks from risers, nor cause any danger of overflowing tanks. But tanks can supply risers.
2. A check valve open upward placed at the foot of each riser length, just before upper riser connects with lower. This allows engines and pumps to fill risers from below to the top of building, but does not allow water to return and thus maintains full height pressure. Pressure from each tank above each riser length can go down only as far as check valve. This keeps pressure at nozzle outlets within workable limits. This set of check valves, with valves just beneath tanks, gives tanks double protection from pressure of tanks above.
3. A check valve near siamese connection, guards engines from pumps; and a check valve near pumps guards pumps from engines.

WATER SUPPLY TO TANKS.

1. Water for 42d and 39th floor tanks will be pumped through a 10-inch main, and 27th floor tank through a 6-inch main by two 500 gallon pumps, supplying 1,000 gallons per minute.
2. Water for all 13th and 13th mezzanine floor tanks will be pumped through 3-inch and 4-inch mains by two 500 gallon pumps, supplying 1,000 gallons per minute. Pumps draw water from a 10,000 gallon suction tank, located in basement.

In the planning of the system some complications naturally ensued. There is little difficulty in providing means for pumping water to such a height, but for fire protection purposes the standpipe should be always charged, and this necessitated a tank supply. A tank supply means gravity pressure, and this raises the question of usable pressure at the lower hose connections. It is evident that a hose stream, supplied by water from a tank at 576 feet high, would have a pressure impossible for men to control. This defect exists to some extent in a large number of high buildings in New York, but the extreme height of the Singer Tower required some corrective arrangement. This was done by dividing the building into a number of vertical sections, and providing an independent tank and riser for each section. As will be seen on the plan, the top tank supplies the 40th-38th floors; the next tank 37th-26th floors; the next tank the 25th-13th floors, and the lowest tank or set of tanks, the 12th-basement floor.

The necessity of having each tank and its riser independent of the others, while all of the risers should be connected so as to receive water pumped either by the house pumps or the Fire Department engines, required a careful and practicable arrangement of check valves. All of the tanks are provided with the customary check valves opening downward, so as to prevent the water coming up, the riser from entering the tank. In addition, there are check valves opening upward in each cross-connection from one independent riser to another independent riser. These up-checks hold back the water from the tank above, but do not interfere with water coming up the riser.

A difficulty which presented itself was furnishing enough pressure for the hose connections on the floors immediately below the tanks. This was overcome by having the connections on the floors below each tank supplied by the riser for the next upper section. For example: the tank on the 27th floor begins to supply connections at the 25th floor, while the connections on the 26th and 27th floors are supplied by the riser from the 39th-story tank.

Another difficulty arose from the necessity of using the same tanks for both house and fire service. The small area of the building did not permit of separate tanks, so the latter had to be arranged for both supplies, but without affecting the fire supply. This was done by extending the house pipe up and into the tank to a specified level, while the fire pipe was extended only to the bottom of the tank. In this way the fire pipe can draw all the contents of the tank, while the house pipe can draw only as much water as is above the top of the pipe. This assures a constant fire supply regardless of what is used for house purposes.

The system has three sources of supply, the tanks, the house pumps, and the Fire Department engines. If the first two are exhausted or out of commission, the Fire Department engines should still be able to pump water to the highest level of the building. The best New York engines are rated at 300-lbs. water pressure, and 150-lbs. steam pressure, and allowing for frictional losses, and the actual working capacity of the engines, they should still be able to pump water to any required height in the building. In case the pumps or the engines are used, it is, of course, unnecessary for them to attain a pressure necessary to pump water to the highest floor, but only sufficient for the particular floor on which is the fire. For example, with a fire on the 25th floor, a pressure of about 200-lbs. at the pumps would be sufficient, under actual working conditions, to supply water on that floor, so that in case of fire in the building the necessary pressure is to be regulated by the engineer.

The pumps are to fill the tanks by mains which are separate and distinct from the fire service risers, and are also arranged to be pumped into the risers direct.

CHAPTER XV.

AUTOMATIC SPRINKLER SYSTEM.

AN Automatic Sprinkler System is a mechanical extinguishing system which works automatically and is operated by the heat of the fire.

Principal Parts. Sprinklers or "Heads," Piping, Valves, Water Supplies, Alarms.

Sprinklers. The Sprinkler or "Head" is the device or mechanism which discharges water on the fire. It has the same purpose as a water faucet, that is, to hold back the water and turn it on when needed. The ordinary water faucet is turned by hand; the Sprinkler Head is worked by heat, which makes it self-acting or automatic. Regular Sprinklers are made to work at 165 degres Fahrenheit, but some are made for higher temperatures, 212, 285, 360 degrees; these are called high test heads. The 212 degree heads are used where the temperature is only a little higher than ordinary, such as, at skylights and other places where the temperature does not exceed 150 degrees. The 285 degrees head is used in dry rooms, boiler rooms and other places where the temperature nearly reaches steam heat. The 360 degrees head is used only in extremely hot places.

The parts of a Sprinkler Head are as follows: The Frame, the Valve, the Strut, the Fusible Link, the Deflector.

The Frame holds the parts of a Sprinkler Head together; the Valve closes the opening through which the water flows; the Strut keeps the Valve tightly closed; the Fusible Link is part of the Strut and melts when heated, thereby breaking the Strut. The Fusible Link is made of solder with the following parts:

Tin, 12 per cent.; Lead, 25 per cent.; Bismuth, 50 per cent.; Cadmium, 13 per cent.

When the Strut breaks it throws the Valve off and the water flows striking the Deflector, which is also called the Splash Plate, because it splashes water above and below and throws it around as much as possible. One Sprinkler Head will wet a space about ten feet in diameter.

Piping. The Piping is the distributing or supply part of a Sprinkler System, that is, it carries the water from the source of supply to the Sprinkler Head. The principal parts of piping are the Risers, the Branches, the Cross-connections and the Small Pipes. The Piping is made of steel or wrought iron.

Risers. These are the main supply pipes and run from top to bottom of the Sprinkler System. They are connected to the water supplies, such as, Tanks, Pumps, Street Mains or Fire Engines. The water usually enters the Risers at the bottom, but in some cases at the top. Risers are best placed to feed a Sprinkler System at its central part instead of at the ends, because this lets the water reach all parts of the System in a better manner.

Branches. From the Risers large pipes are taken off at each floor to supply the Floor System. From these large horizontal feed pipes, the smaller pipes which hold the Heads are taken off.

Cross-Connections. These are large horizontal pipes which connect one Riser with another Riser, so that if water is admitted into one Riser it can flow across into the other Riser and thereby make good circulation of water which will help to supply the entire system.

Small Pipes. Into the Small Pipes the Sprinkler Heads are screwed from eight (8) to twelve (12) feet apart and staggered, that is, the Heads on two parallel lines of pipes do not face each other straight across, but are set to one side or diagonally. The Heads are usually placed upright and pointing to the ceiling, but sometimes they are placed downward and pointing to the floor. The distance from the ceiling varies from three (3) inches to ten (10) inches, but six (6) or eight (8) inches is the best distance, the measurements being made from the Deflector.

Sizes of Piping. These vary according to the size of the system, the number of Heads or the amount of water that is needed to feed the system. Risers are four (4), six (6) or eight (8) inches in diameter, and the Branch Pipes vary from three-quarters of an inch to four (4) inches.

Valves. Valves are mechanisms whose purpose is to control the flow of water in a Sprinkler System or parts of it. The kinds of Valves used in Sprinkler Systems are:

Gate Valves, which are used to shut off the Sprinkler System in whole or part, or to stop the flow of water when necessary.

Check Valves, which are used to prevent water flowing in the wrong direction or beyond a desired point.

Alarm Valves, which are used to operate a signal when the water flows in case of fire, or Sprinkler Heads open.

Dry Pipe Valves, which are used to control the water in a Sprinkler System, which has the pipes filled with compressed air.

Draw-off Valves, which are used to empty the piping or the tanks when this is necessary.

Gate Valves. All gate valves used in the Sprinkler Systems are required to be of the indicator pattern, that is, to show by some sign or mark that they are open or shut. Gate Valves in supply pipes are required to be kept open in a secure manner, usually by riveted leather straps, padlocked chains, or patent wire straps. Also by sealing all valves and having some system of notification in case the seals are broken. Gate Valves are also required to be placed where they can be easily seen and easily reached.

Main Gate Valves. A Sprinkler System has one valve which controls all automatic water supplies, so that by closing this valve all water is stopped from flowing to the Sprinkler Heads. This Main Shut-off Valve is placed in the main supply pipe or Riser, at the bottom of the Riser, if the water flows upward into the system, or at the top of the Riser, if the water flows down into the system.

Floor Valves. In some Sprinkler Systems there is a Shut-off Valve on each floor, so that the Sprinkler System on each particular floor can be shut off without shutting off other parts of the system.

Gate and Check Valve. In the main feed pipe connecting each separate source of water supply to Sprinkler System, a Gate and Check Valve are placed so that each separate source of water supply can be shut off without affecting the others, and so that the water from one supply will not run into another supply. If the two valves are placed near each other the Check Valve should be placed nearer the source of supply, so that by closing the Gate Valve, the Check Valve can be examined or repaired.

Check Valves. These are required to be of a straightway pattern, and are usually placed in horizontal pipes. Check Valves are placed in Sprinkler Systems at the following places:

Fire Engine Connection, with Check swung in towards the Sprinkler System and away from the Engine Connection.

Tanks, with Check swung towards the Sprinkler System and away from the Tank.

Pumps, with Check swung towards the Sprinkler System and away from the Pump.

Street Water Mains, with Check swung in towards the Sprinkler System and away from the Mains.

Alarm Valves. Sprinkler Systems contain Alarm Valves, which are worked by the flowing of the water. The flowing of the water causes the alarm to make an electric connection, which starts gongs ringing or telegraphs a signal to a Fire Alarm Company, and Engine House or other place.

Tank Alarms. Water Tanks, which are part of Sprinkler Systems, are fitted with electric alarms which sound signals when the water in the Tanks gets too high or too low. These Tank Alarm Signals are sent to the office of the Fire Alarm Company, or they may notify watchmen on the premises.

Dry Pipe Valves. In buildings which are not heated and in other premises where water in the Sprinkler System would freeze, the pipes are filled with compressed air, and a Dry Pipe Valve placed in the system. The Dry Pipe Valve is worked by compressed air flowing out of the Sprinkler Pipes; it then permits the water to flow into the pipes in the same manner as a regular Wet Sprinkler System. When a Sprinkler Head on a pipe filled with compressed air is opened by a fire, the air flows out and thereby works the Dry Pipe Valve.

Water Supplies. For automatic sprinkler systems the following are the usual sources of water supply:

Gravity Tanks, Pressure Tanks, Public Water Works, Fire Pumps, Fire Engines.

Gravity Tanks. These are the oldest and most common sources of supply. They are usually built of wood staves bound by metal hoops, but lately steel tanks are being more used.

Gravity Tanks are placed above the highest line of the sprinklers, at least twenty feet, in order to get a good fall of water and thereby secure enough pressure. They are provided with a cover, also, a ladder to enable inspectors to examine the contents.

Gravity Tanks should have a capacity of at least 5,000 gallons, should be used only for sprinkler supply, and have an independent drain pipe, a filling pipe, a discharge pipe, an overflow pipe, and a tell-tale to show the water level. If exposed to freezing, the tank should be enclosed in a house or a steam coil should be placed inside the tank.

Pressure Tanks. Pressure Tanks are used as a secondary or auxiliary supply for sprinkler systems. The great advantage is in furnishing a heavy pressure of water automatically, as they give an initial pressure of 75 pounds or more.

Pressure Tanks are built of steel, cylinder in shape, placed horizontally and located in the upper part of a building. Their capacity runs from 4,500 gallons up, and they are kept two-thirds full of water. The remaining one-third of the tank is air under such pressure as to give fifteen pounds pressure at the top line of sprinklers.

Pressure Tanks are fitted with a gauge glass to show the level of the water, a pressure gauge to show the pressure in the tank, a filling point indicating the two-thirds water level, filling pipe and drain pipe. A pump is used to keep up the water level, and a steam or electrical air compresser provided to put the air in the tank under pressure.

Public Water Works. The street mains of the public water supply are an excellent sprinkler supply, if there is sufficient pressure and quantity of water. A pressure of ten pounds at the highest line of sprinklers, if no sprinklers are working, is considered satisfactory, but twenty-five pounds with forty or fifty sprinklers operating is recommended as a better requirement. One objection to public water mains is the necessity of having the supply metered, but this objection has been met to some extent by a special meter.

Fire Pumps. Pumps which are properly designed and installed, and which have sufficient steam and water supplies, are one of the best sources of water supplies for automatic sprinkler systems. Fire Pumps for sprinkler supply service must be prepared to pump at full speed and capacity for some length of time and on short notice, as well as to withstand wear and tear and be unlikely to be disabled.

Such a pump should be large enough to feed a reasonable number of sprinklers when operating. A 500 gallon pump is considered the minimum capacity, but experience is demonstrating that larger pumps are practically necessary. Pumps and boilers should be located where fire and smoke will not put them out of service, usually in a detached building or fireproof section of a building. The feed water supply for the pump and boilers should be protected against breakage or overdraft by fire engines or hydrants. A pressure of fifty pounds should always be maintained and the water supply should be sufficient for a sixty minute working of the pump as a minimum.

The accepted pump for sprinkler supply purposes is known as the Underwriters' Fire Pump, which is manufactured by most of the pump manufacturers according to standard specifications. The chief difference between the Underwriters' Fire Pump and the ordinary commercial pump are:

First. It's steam ports and water passages and air chamber are made much larger than in common trade pumps, so that a larger volume of water can be delivered in an emergency without water hammer.

Second. It is "rust proofed" that it may start instantly after disuse, by making its piston rods and valve rods of Tobin Bronze, instead of steel; its water pistons, stuffing boxes and rock-shaft bearings of brass instead of cast iron. Its valve levers are made of steel or wrought iron forgings, or of steel castings.

Rotary and Centrifugal pumps for standard supply purposes are also in use to some extent, while electric pumps have also been manufactured and are being introduced.

Fire Engines. The Fire Department through its engines or high pressure lines provides one of the best known non-automatic supplies for sprinkler systems. By attaching hose lines to a connection at the street, they can furnish additional water and increased pressure to help out the regular water supplies. The details of Fire Department connections to sprinklers are practcally the same as for standpipes.

MAINTENANCE OF SPRINKLER SYSTEMS.

"1. Sprinkler valves to be kept open at all times. Valves to be strapped with leather straps and to be regularly inspected weekly by some responsible person. Sprinklers are worthless if valve controlling them is shut.

"2. In case of fire have sprinklers which open replaced and water turned on at once. Keep a man stationed at sprinkler valve until it is opened.

"3. Keep at least 12 extra sprinklers on hand at all times. In case you have many high test heads in your plant, keep extra high test heads on hand also. We suggest that these be kept on a rack or in a glass front cupboard in engine room, office, or other suitable place.

"4. Have watchman, engineer, superintendent, foreman, and others instructed as to location of sprinkler valves and extra sprinklers. Also to take the following steps in case of fire: 1st. Call fire department or other help. 2d. Endeavor to extinguish fire. 3d. When absolutely sure that fire is out, shut off valve controlling sprinklers that opened. 4th. Replace these sprinklers with others of same melting-point and turn on water at once. 5th. Sweep up water and try to prevent unnecessary damage.

"5. Keep water supplies in service at all times. Tanks to be kept full and free from ice. Pumps to be started weekly, etc.

"6. Hire only reliable watchmen and engineers. Many companies leave their valuable plant for nearly half the time in the hands of ignorant, low-priced watchmen, who are useless or more than useless in an emergency.

"7. Do not build additions to your plant without first notifying your insurance agent. Have sprinkler equipment and other fire appliances installed as soon as possible, and in any event before the addition is used for manufacturing purposes.

"8. Do not build partitions or store goods that will interfere with sprinkler distribution.

"9. Close cold weather valves November 1st and open them promptly April 1st.

"10. Replace all sprinkler heads that appear noticeably corroded or injured in any other way."

CHAPTER XVI.

SPRINKLER SUPERVISORY SERVICE.

SPRINKLER Supervisory Service had its origin in the minds of practical fire insurance men, whose experience with automatic sprinklers showed the necessity of a system of constant supervision by an agency entirely outside of and independent of the property owner.

It was the experience of inspectors and engineers with the automatic sprinkler system, while the best known means of fire protection, was sometimes found out of commission and unable to perform its work. This was due in many cases to thoughtlessness, carelessness or malice. In other cases, the sprinklers would operate and extinguish the fire, but through the failure of the local alarm service, or the absence of anyone capable of shutting off the sprinklers, water damage would result causing almost as much loss as if the building had been destroyed by fire. In a department store at Omaha, Nebraska, the sprinklers ran nearly all day Sunday.

These were the reasons which demanded a Sprinkler Supervisory Service, which would eliminate the troubles referred to. After tests and administrations a number of things were clearly and definitely proven;

1. No gate valve in the sprinkler system can be closed in whole or part without immediate notice to an outside Central Office.

2. Not more than two inches of water can go down in any of the sprinkler tanks without immediate notice to Central Office.

3. Not more than two pounds of pressure from any predetermined point can go down in either the pressure tank or fire pumps without immediate notice to Central Office.

4. The water in any exposed tank can neither freeze nor become dangerously warm without immediate notice to Central Office. The transmitting apparatus controlling every branch of this service is so designed, as to transmit one signal when any "trouble" occurs and another distinguishable from the first signal when the "trouble" is remedied. Thus informing Central Office at all times of the exact conditions, and

5. The presence of water leakage equal to the discharge of a single sprinkler head is recorded at Central Office and in turn at Salvage Corps and Fire Department headquarters, immediately it occurs

This last accomplishment not only reliably assures notice of the presence of sprinkler leakage—the device being free from false alarms due to variable pressure in the system, or water hammer—but likewise causes each sprinkler head to perform the dual function of a sprinkler head and a thermostat.

6. The operation of a sprinkler head, or the pulling of a manual fire alarm box, that is included in this equipment, assures at the earliest possible moment notice to the Fire Department and Salvage Corps of the presence of fire and thus brings immediately the most important auxiliaries to the aid of the sprinklers.

CHAPTER XVII.

PERFORATED PIPE SPRINKLERS.

THE equipment of cellars with fire extinguishing appliances is contemplated by Section 102 of the New York Building Code, which provides for perforated pipes or automatic sprinklers, but the work of securing this protection is prosecuted by the Fire Department under authority of Section 762, Greater New York Charter.

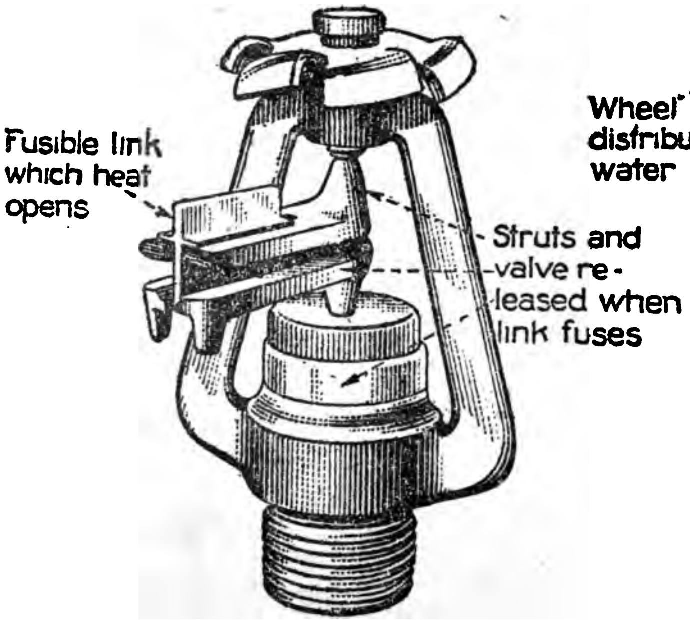
The perforated pipe is a working out of the idea of distributing water for fire extinguising purposes in places where it is not possible to do it by hand or by hose and nozzle. As carried out, a system of pipes which have been perforated to admit of water discharging through the openings, are placed close to the ceilings of rooms or premises to be protected, and when fire occurs water is let into the pipes which are to carry it to the fire area and discharge it upon the fire. This plan makes of the pipes not only a means of supply but also a discharging device through the whole length of the piping, with the result that the entire area covered by a system of piping receives the discharge of water.

As installed in New York City, perforated pipe systems are intended to be supplied only by fire department engines pumping through a connection at the front of the building. This connection is the regulation two-way inlet pipe or Siamese connection, and attached to it, or nearby, is placed a metal sign of raised letters stating whether the connection supplies the cellar or sub-cellar. The Siamese connection is attached to a 4-inch feed pipe, which leads to the lines of perforated piping. The details of the piping are given in the following regulations:

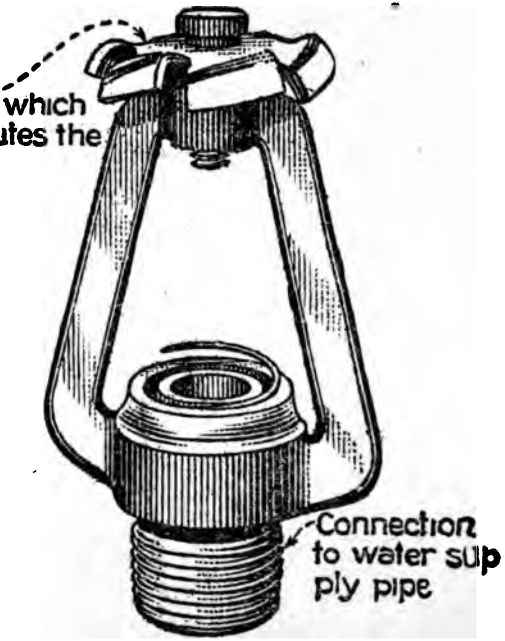
Regulations for Perforated Pipes in Cellars and Sub-cellars. —All perforated pipes are to be of wrought iron or steel, and capable of withstanding a pressure of 300 pounds to the square inch.

They shall be suspended with proper hangers, not less than six inches below the ceiling and parallel thereto, running full depth of building, and placed 12½ feet apart on centers, and 6 feet from side walls, to be securely fastened and properly braced to withstand vibration.

Pipes shall be 1½ inches internal diameter, perforated with 1-16 inch holes; holes to be on the quarters 2 inches apart longitudinally, and to be staggered, making 24 holes to the running foot of pipe. Holes must be drilled, not punched.


Fusible link which heat opens
Struts and valve released when link fuses

AUTOMATIC SPRINKLER CLOSED.


Wheel which distributes the water
Connection to water supply pipe

AUTOMATIC SPRINKLER OPEN.

These 1½-inch pipes to be connected with a feed pipe 4 inches internal diameter, placed close to and parallel to front or side walls of building, and connected by and with a 4-inch pipe terminating outside of said wall in a 3-inch Siamese connection, to be fitted with proper clapper valve or valves. One Siamese connection to furnish water to no more than a total of 400 feet of perforated pipe. No single line to be longer than 100 feet.

Sub-cellars require separate equipment.

Cast-iron fittings must not be used.

All necessary bends will be avoided, and where needed such bends or curves to be easy and of a radius not less than six times the diameter of the pipe.

A suitable iron plate on outside of building, with raised letters, must be fastened to the wall, or other approved place near cellar connection, to read:

"TO PERFORATED PIPES IN CELLAR."

Sign for sub-cellar to read:

"TO PERFORATED PIPES IN SUB-CELLAR."

Drawings and duplicate, consisting of plans and sections drawn to ⅛-inch scale showing proposed location of pipe with proper written description must be submitted.

The use of wrought iron or steel pipes and fittings is necessary, because cast iron does not stand the sudden contraction caused by the cold water coming in contact with the heated metal. The hangers are the various kinds used by pipe fitters. and in the case of iron beams are clamped to the beams; in the case of wood beams, they are attached to lag screws, which are set into the wood beams to a depth of at least four inches. The drilling of the holes instead of punching is necessary, because the drilling makes a clean cut hole, whereas the punching is likely to leave a roughened edge or burr on the inside of the hole, which not only collects rust and other accumulations, but also blocks the discharge of water.

The perforations are made on the quarters of the pipes and staggered lengthwise to favor a more complete distribution of water and cover as much space as possible.

When the piping is in position it has to be adjusted to have the openings set in this manner, because if not so placed the distribution of water is not so effective.

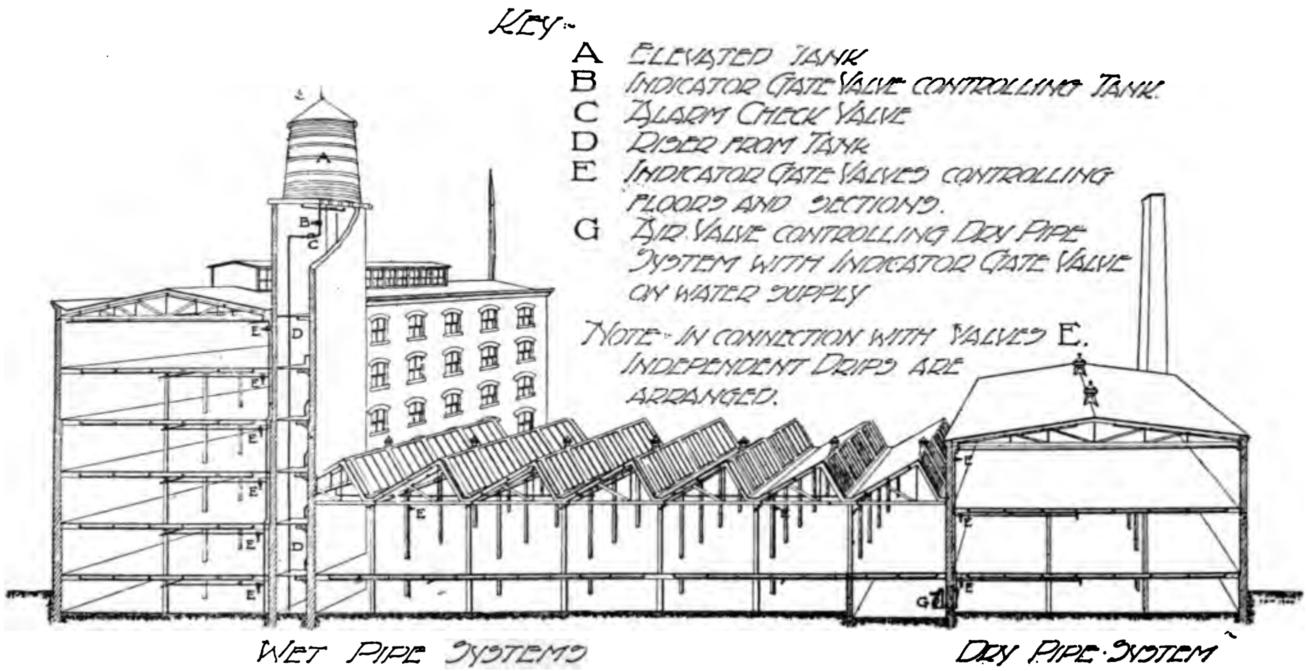

KEY:-
A ELEVATED TANK
B INDICATOR GATE VALVE CONTROLLING TANK.
C ALARM CHECK VALVE
D RISER FROM TANK
E INDICATOR GATE VALVES CONTROLLING FLOORS AND SECTIONS.
G AIR VALVE CONTROLLING DRY PIPE SYSTEM WITH INDICATOR GATE VALVE ON WATER SUPPLY
NOTE:- IN CONNECTION WITH VALVES E. INDEPENDENT DRIPS ARE ARRANGED.
A
B
C
D
E
G
WET PIPE SYSTEMS
DRY PIPE SYSTEM

Diagram of Complete Sprinkler System

CHAPTER XVIII.

WATCHMAN SERVICE.

THE watchman as a protection against fire and burglary has come to be recognized as indispensable. Ordinary prudence forbids leaving buildings and their contents without any care or supervision during nights, Sundays, holidays, and other non-business periods, and the employment of a watchman may be said to have become the rule rather than the exception.

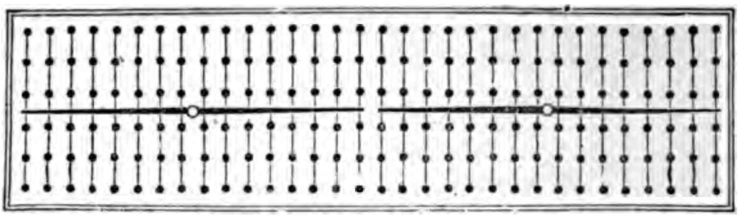
In respect to watchman service, the average employer fails to consider the great responsibility placed on the watchman. For the greater part of each day and for forty-eight or seventy-two hours continuously, the entire property is entrusted to his care and to properly fulfill this duty requires the full exercise of a man's faculties. Manifestly, the man should not only be physically and mentally competent to perform a watchman's duties, but the service demanded of him should be arranged with some regard to a man's capacity for efficient service.

Watch service at best is lonely, tedious, and fatiguing, and whereas in military or naval regulations the tour of duty is limited to a few hours, in business practice it is the entire night of twelve hours or more. It is the severest test of a man's endurance to exercise proper care and vigilance for so long a period and this affords some explanation of the many instances of large fires getting under headway, without discovery by a watchman.

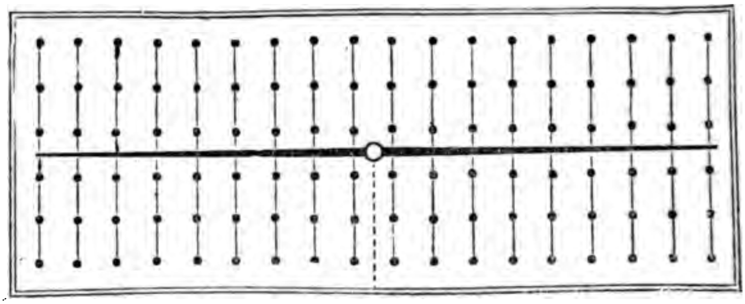
To promote the efficiency of watchman service, a plan is in use which requires the watchman at regular intervals to visit certain designated places called stations, and to record at these stations the time of his visits. This record may either be kept by a watchman's time-recording device or it may be part of a Central Office system of supervision.

The watchman's time recorder, commonly known as a watch clock or time detector, consists of a recorder and means of operating it. The recorder is usually a clock mechanism with an operating device which imprints on a sheet of paper divided into hours and minutes a distinctive mark each time it is operated. This is done either by a key in the case of the portable clock or by an electric device in the case of the stationary clock.

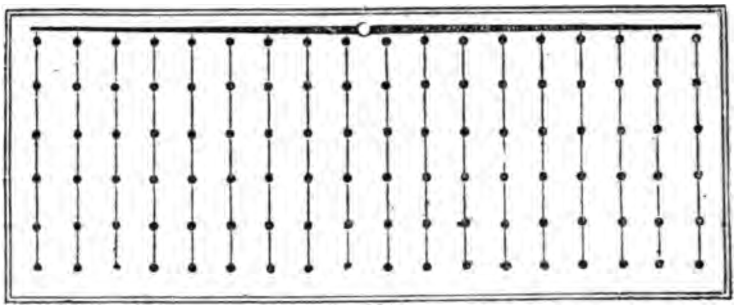
The portable watch clock which the watchman carries with him on his rounds is the simplest form of watchman's time recorder, and in shape and size is much like a small alarm clock; the record is made on a paper dial by inserting a key, the turning



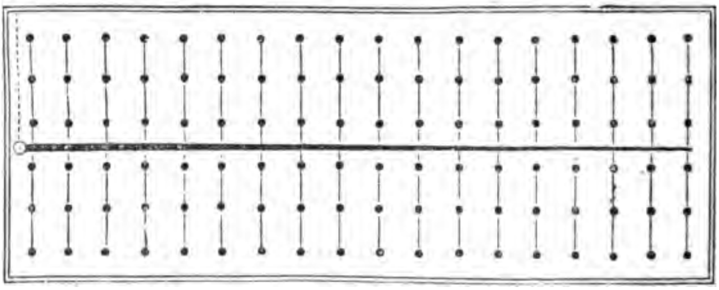
Best Method of Piping a Large Building



Center Central Feed to Automatic Sprinklers



Side Central Feed to Automatic Sprinklers



End Central Feed to Automatic Sprinklers of which punctures or embosses the dial. Each station has a distinctive key and as the paper dial revolves with the working of the clock there is shown the exact hour and minute and the number of times that each key is used.

A development of the portable clock is the stationary clock which in appearance is like a typical office clock; in its working, it is similar to the portable clock in so far as it uses a clock mechanism and a revolving paper record, but it differs in being electrically operated. Instead of a key, the marking mechanism is a needle point held back of the paper record; this point is mounted on one end of a pivoted lever bar, at the other end of which is an electro-magnet. When electricity flows through the coil of wire around the magnet, the lever bar is attracted and the movement forces the point into the paper record. For each station there is a separate marking mechanism connected by wires to a small generator at the station. This generator, called a magneto, is an electro-mechanical device for producing an electric current, and is operated by turning a handle, which is carried by the watchman. When the latter visits a station and works the magneto by inserting and turning the handle, the electric current produced operates the marking mechanism in the recorder and the time of the visit is indicated on the record sheet.

Portable and stationary clocks simply make available the following morning a record of the watchman's patrols and do not exercise any immediate control or supervision of his movements during the night. This is accomplished by Central Office systems of supervision and fire alarm conducted by certain telegraph and burglar alarm companies. These systems equip the watchman stations with a special type of signal box, similar in design and mechanism to a fire-alarm box and usually operated by inserting a key and winding a spring. When the spring is released it starts in motion a toothed wheel, which is arranged to make electrical contact with a registering device in the Central Office. This registering device, the "ticker," generally familiar from its use in telegraph news service, imprints on paper tape a mark for each tooth on the wheel in the station box, the teeth being spaced to correspond to a given number, which is used as the box signal. Each box has a separate signal and when the watchman visits a station, he transmits its respective signal to the Central Office, where an operator records the time it is received on the register tape.

As the watchman is required to regularly visit the stations at stated periods, a schedule time is set for the receipt of the signals and in the event of the watchman failing to transmit a signal within ten minutes of the schedule time, a Central Office reserve watchman called a "runner," is despatched to ascertain the cause.

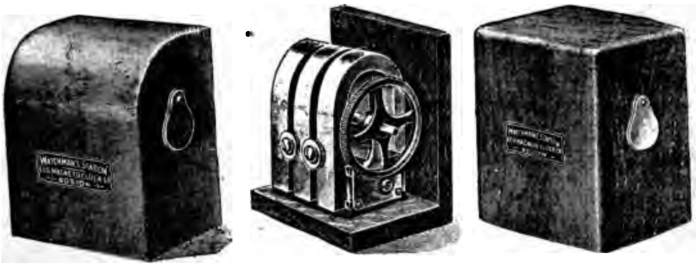
The value of this provision is apparent, for if the watchman should prove wilfully delinquent or be physically disabled by sickness or accident the "runner" performs the watch service, which otherwise would be neglected, possibly at the precise time when it was most needed. The Central Office company furnishes to its clients and other interested parties a daily statement showing the performance of watch service by the various watchmen and indicating any instances of delinquent service.

In addition to the watch signal the Central Office station box is arranged to transmit a fire signal which in one type of box is accomplished as follows. In one corner of the box cover is set a piece of glass, the breaking of which opens the box and gives access to a lever. When this lever is pulled down it winds the spring operating the toothed wheel in the same manner as turning the key, but it is arranged to give the wheel seven revolutions with the result that the usual watch signal is first transmitted and then repeated seven times, in each case preceded by the Morse symbol (- — -) for the letter F, signifying fire. This makes available a fire alarm wherever a watchman's station is placed, and in case of need, the watchman or any other person is not obliged to travel an indefinite distance before being able to send an alarm. When a fire signal is received at the Central Office, the number of box informs the operator of the location of the fire and he is thus enabled not only to notify the Fire Department that there is a fire in a certain building, but also to state which part of the building, a piece of information of considerable value in the case of buildings of great height or large area.

Portable Clock and Key Box

Magneto Handle

In connection with watchman service, the National Board of Fire Underwriters have published standards adopted by the National Fire Protection Association, which aim at promoting the use of efficient and reliable devices or systems. In addition to general requirements, looking to the practical working of the recorders, there are particular requirements having regard to careless or malicious handling. With portable clocks, for instance, it is required that the clock run for forty-eight hours without rewinding, that it be strong enough to withstand accidental rough usage, that it be designed to prevent access to the mechanism, that it record any attempt to make false records on the dial, that it make impracticable a duplication of the keys, and that these be permanently attached to the stations. Some of these requirements also apply to the stationary clock, for which there are special requirements, such as the use of an eight-day clock movement, the use of a puncturing device for marking the record sheet, and the use of magnetos at the stations. The advantages of a magneto consist in less liability to break down through neglect or accident and the greater security against making records without visiting the stations. This latter may be done when the clock is operated by a battery circuit, but the use of a magneto is a practical guarantee that the watchman is compelled to visit each station in order to make a record. The Central Office system of supervision, when it conforms to necessary requirements, is regarded as the most effective means of assuring proper watch service. The Central Office should be located in a building provided with adequate protection against fire; it should be equipped with proper instruments for automatically receiving and recording the watch signals; the electrical equipment and maintenance should conform to the best practice; the station box should be designed to transmit fire signals in addition to the usual watch signal; the watchman service records should be made available for all interested parties and the extra watchman employed should be competent men.



Mechanism of Magneto and Cases

The application of these standards is made by the Underwriters' Laboratories, Chicago, Illinois, which subject to test devices submitted by manufacturers. These tests are based on the actual service likely to be demanded of the devices and they constitute a fair indication of efficiency or non-efficiency. When a device or system has successfully withstood the tests, and the manufacturer expressly agrees to observe the specifications on file with the Underwriters' Laboratories, it is published on the list of approved devices issued by the National Board of Fire Underwriters.

The lantern used by the watchman is in itself a source of danger and as a matter of precaution only lanterns of good manufacture of the safety pattern should be used. Moreover, it should be filled and lighted only in a safe place, and to accomplish this, it is usually locked by attaching a small padlock, after the lantern is lighted, in such manner as to prevent access to the flame. This removes the chance of the watchman exposing the flame or relighting the lantern, in close proximity to highly volatile liquids, cotton or other extra hazardous materials. If it is necessary to relight the lantern, the watchman should be required to return to the place indicated for lighting the lantern.

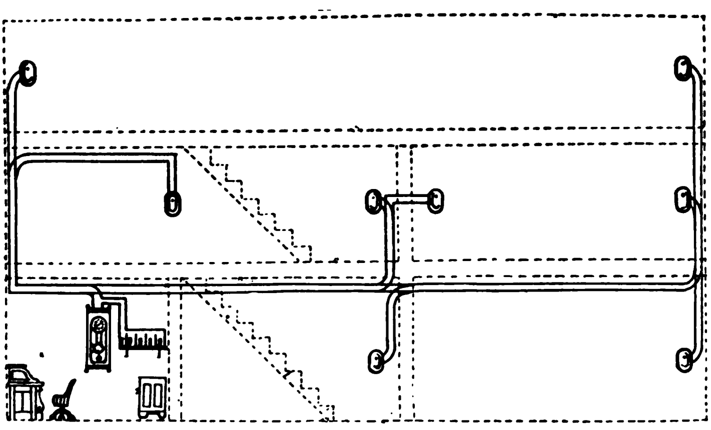


Diagram of Wiring and Stations

Time of Service.—Watchman service is necessary every night, during the day-time of Sundays and holidays, and at all other times when the usual business of the day is suspended.

Patrol Periods.—Patrols, tours or rounds should be made at least hourly, to begin immediately after the day's business is ended and to continue until just before the day's business is resumed; in other words, no part of the premises should be left without supervision for longer than one hour at any time during a non-business period.

Stations.—Watchman stations should be placed throughout the premises in sufficient number and so located that in order visit them the watchman is compelled to oversee every part of e premises.

Stations should be numbered in the order that the watchman required to make his patrol.

Watchman's Time Recorder, or Central Office System of upervision.—The use of either an approved watchman's time corder, or Central Office system of supervision, is recommended.

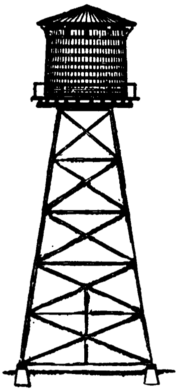
Iron Magneto Boxes.—Magneto boxes should be of iron hen exposed to the weather, to dampness, to extreme heat, to cid fumes, or to other conditions for which the wooden box is ot adequate protection.

Wiring.—The wiring for stationary recorders should con-orm to the National Electrical Code.

Portable Watchman's Time Recorders.—Key boxes at all ations are necessary, to be permanently attached and the fasten-gs sealed and signed.

Records.—The watchman's records should be preserved r at least thirty days.

Watchman's Lantern.—The lantern used by the watch-n is required to be of the safety pattern, with the oil pot perma-tly fastened, or if removable, to be contained within the lan- base and removed by lifting from the top. It is to burn only al, lard or sperm oil.



CHAPTER XIX.

INTERIOR FIRE ALARM.

THE General Specifications for a Fire Alarm System for factory buildings issued by the New Jersey Department of Labor explains what constitutes a good fire alarm system for warning people in a building, or starting a fire drill.

The system shall consist of one or more specially designed (1) fire alarm boxes on each floor of the factory building, connected by (2) electric wiring to (3) alarm gongs on all the floors and to an (4) annunciator on the ground floor and to (5) batteries in the cellar.

Method of Operation.—When an alarm has been sent from one of the fire alarm boxes—say on the fifth (5th) floor—all the alarm gongs on the various floors shall ring the number of the floor where the box from which the alarm was sent is located, and repeat the signal three (3) times. (In the above instance the gongs would ring five (5) strokes, and repeat them three (3) times.) The annunciator on the ground floor would lower one of its drops (in this instance No. 5), and the gong on its top would start vibrating and continue to ring until someone would go to it, and switch it off by a two-point switch, which would bring into circuit the single-tap gong on the annunciator, connected with the main gong line of wiring. Signals may then be transmitted over the entire system by means of the push-button on the annunciator to the gongs or by means of the push-button or any of the signal boxes to the gongs, including the one on the annunciator, in accordance with a code devised for the purpose of transmitting such information as may be desired.

These push-buttons may be used for testing the system daily.

(1) Fire Alarm Boxes. These are to be of the "messenger call type," so designed that when the lever is pulled down and released the make and break wheel will ring all of the gongs throughout the building the number of the floor on which the box has been operated, and will repeat this number three times automatically before stopping. Each box is to be equipped also with a push-button set into its face, to be used at any time for testing the gongs or batteries and for special code signals. These boxes are to be equal in quality to those made by the Bunnell Co., the Manufacturers and Inventors Electric Co. or the Western Electric Co., and shall consist of a case enclosing the automatic movement complete, which shall be non-interfering and succes-

sive in its action. All make and break contacts shall be platinum or hard silver, and all parts of the mechanism shall be of the best grade of material and workmanship.

This specification is not intended to completely describe the signal mechanism and containing case, but only to indicate the type desired, samples of which shall be submitted for examination and test to the Department for approval.

(2) Wiring. All wiring must be of standard damp-proof office type of ample size to operate all the gongs. It must be run in a neat and workmanlike manner, and where it passes through floors or walls it must be properly protected, all in accordance with the requirements of the authorities having jurisdiction over such matters.

(3) Alarm Gongs. There shall be installed on each floor of the building electric gongs of the single-stroke type, sufficient in number and size to be plainly heard throughout the floor above the noise of machinery or other sounds, and these are to be connected by the wiring to the signal boxes and to the annunciator on the ground floor.

These gongs are to be of the highest grade skeleton type, with pivoted armature and platinum contacts especially wound for low resistance.. Faraday class "A" gongs or their equal will be approved.

(4) Annunciator. This is to be of the Standard Fire Alarm gravity type, with a sufficient number of drops to identify the location of all the signal-boxes. It shall have on it two gongs, one to be of the vibrating type, to be in circuit with and operated by the various drops through a relay on a separate battery. The other gong is to be of the single-stroke type, and is to be operated by a push-button in the face or side of the annunciator, both of which are to be in circuit with the main line battery. A two-point switch shall be connected up between these gongs so as to throw one or the other of them into circuit.

(5) Batteries. The relay battery must be of such a grade and sufficient in number of cells to operate the vibrating bell on the annunciator continuously for three hours.

The main battery must be of such grade and sufficient in number of cells to ring all the gongs simultaneously and distinctly twelve (12) times without showing weakness.

A duplicate set for the main line is to be supplied with a two-throw switch, so arranged that either set may be used in case of emergency.

All of these batteries are to be inclosed in a substantial wooden box, having its top hinged and front equipped with a spring catch, and this box must be located in a cool, dry place.

Guarantee.—The entire system, including (1) alarm boxes, (2) wiring, (3) gongs, (4) annunciator and (5) batteries, must be guaranteed against any defects whatsoever for a period of one year from the date of acceptance by the department, with the exception of the renewing of the batteries as may become necessary. Any defects which may develop in the equipment during this period must be made good by the contractor without additional expense to the owner.

Tests.—All the details of the installation and a thorough test of all apparatus connected with the system must be made in the presence of the department's inspector before final acceptance.

The system must be tested every morning before the hour of starting work in the building to insure its being in operating order for the day.

CHAPTER XX.

AUTOMATIC FIRE ALARM SYSTEMS.

DEFINITION. An Automatic Alarm System is an electrical-mechanical device, which is operated by the heat of a fire and sends alarm signals to the Fire Department, the office of an alarm company, or other places.

Principal Parts. The principal parts of an Automatic Alarm System are:—Thermostats, Conductors, Transmitters, Annunciators, Manual Alarm Boxes, Signals.

Thermostats. Thermostats or the Automatic Alarm proper, are the devices or mechanisms which operate when heated by a fire. They are made sensitive to heat, and arranged to work at a temperature a little above the ordinary temperature of the room in which they are placed, usually from 140 to 160 degrees. Most Thermostats are electrical in their operation, but pneumatic Thermostats are also in use.

The electrical Thermostats depend for their operation on the heat of a fire melting part of the mechanism made of solder and therefore quickly affected by the heat. Another method of operation is by having metal parts of the mechanism expand as a result of the heat being applied.

As a result in either case, an electrical circuit is completed and the electrical current sets in operation the transmitting mechanism, by which the alarm signal is dispatched. The pneumatic Thermostat depends upon the melting of a solder part, by which a piston is moved and air compressed, so that the resulting pressure sets in operation the transmitter in the same manner that the electrical current does in the case of the electrical Thermostat.

Thermostats are placed on ceilings from eight to twelve feet apart in practically the same manner as automatic sprinkler heads, the idea being to have every portion of a building guarded by Thermostats. When installed in buildings with automatic sprinkler systems, the Thermostats should be placed so as to be separated from the sprinkler heads, and they should also be set to operate at a lower temperature than the sprinkler head. The reason for this is, if both have the same working temperature, the sprinkler head may discharge water at the same time or before the Thermostat works and thereby cool the Thermostat, thus destroying the value of the Thermostat as an extra means of alarm. It is also desirable to have the Thermostat operate first and summon assistance in order to avoid the water damage from sprinklers.

Conductors. Thermostats are connected by wires with a Transmitter, in the case of an electrical Thermostat, and by a tube in the case of air Thermostats. The wires are the usual electrical conductors used for telegraph purposes.

Transmitters. The Transmitter as part of the automatic alarm system is the fire alarm box proper, or the mechanism by which a signal is sent from a building to the fire alarm company, fire headquarters direct, or to other desired places. Transmitters are usually a clock mechanism with a toothed wheel to make electrical contacts which will give the fixed signal number. They usually operate recording apparatus in the office of the fire alarm company and other places, by which the signal is printed on paper tape as well as announced by means of gongs or sounders. Transmitters are located in the building and are connected by wires to the Thermostats as well as to the central office and with local gong alarms.

Annunciator. The Annunciator is a device placed upon the front of buildings to show on what floor or in what part of a building the fire is, and to inform the Fire Department, so that they may reach the site of a fire without loss of time. It has a dial or target which shows the different parts of a building, and an indicator which points to the particular part of a building in which the fire has started. If the Automatic Alarm System is in normal condition, the target is set at the letters "O. K." which means that the system is ready to send in an alarm.

Manual Alarm Box. It is customary to put in the Automatic Alarm System, an alarm box which can be operated by hand, the same as the regulation street fire alarm box. It is usually placed near the main exit of the building, but additional boxes may also be placed at each floor exit.

Signals. Each building, or separate section of a building has its own fire alarm signal number and in addition, it is usual to divide the building into several parts according to the separate circuits used. This enables floor signals to be sent, so that in addition to notifying the Fire Department that there is a fire in a particular building, the particular floor or group of floors can also be furnished.

THE COMPENSATING TYPE OF AUTOMATIC ALARM.

A recent development in the Automatic Alarm, and what really makes a revolution in this Fire Prevention device is the use of heated air as the thermostat, or active mechanism. As is well known, air expands when heated and produces pressure which is the principle upon which the new Automatic Alarm System is based.

The special parts of the Compensating Automatic Alarm System are: Tubing, Detector, Transmitter, Test Coil.

Tubing. The Tubing is of brass and is run in continuous lengths along the ceilings or walls of buildings. At one end, it is connected to the Detector and at the other end to the Test Coil. The Tubing before being installed is rigidly tested for leaks, continuity and the presence of moisture or other foreign matter. An air pressure of 150 pounds is used to locate faults and leaks in Tubing. The joints of the Tubing are brazed with silver solder and borax, ordinary solder not being permanent or safe for this purpose. The brazing practically welds the Tubing into one continuous piece.

Detector. The Detector is a small device whose purpose is to make an electrical contact and thereby operate the Transmitter. It has a pure silver foil diaphram, which is pushed outward by the expansion of the air in the Tube when heated. When the diaphragm is pushed outward it makes an electrical contact which starts the Transmitter working. The electrical contact in the Detector is of pure platinum and is impervious to corrosion.

The Detector is arranged to operate when the air in the Tube is heated at a certain fixed rate. This is the important feature of this system, because it does away with false alarms due to steam or other ordinary rises of heat in a building, as well as making the alarm work, regardless of whether the ordinary temperature of a building is very low or very high. This is possible, because by long experiment, the manufacturers and inventors have found out that a real fire causes the air in the Tubing to increase in temperature at the rate of about four degrees per minute. The Detector, therefore, is set to operate on a rise of temperature of four degrees or more. If the rise of temperature is less than four degrees, the Detector does not operate, because it has a Vent, which is in the nature of a safety valve.

As the Detector is set to operate at a fixed rise of temperature, that is, four degrees or more, it makes no difference whether the system is in a building with a low temperature or a high temperature, because it is the rate of rise that operates the device. In a cold storage room, for example, with a temperature below freezing, or in a hot room with a temperature of 150 degrees, the Detector will work just as well, for the reason that its operation has nothing to do with the temperature of the room, but with a sudden rise of temperature, enough to mean that a fire has started.

The Vent in the Detector consists of a glass tube which has a very small opening. This opening allows the air to escape, so long as the air is heated less than four degrees per minute. As long as the temperature rise is less than four degrees, the Vent releases the air, the pressure is kept down and saves the Detector from operating. If the temperature rise is at the rate of more than four degrees, the Vent cannot let the air escape fast enough, so that the expansion of the air is enough to push out the diaphragm and make the electrical contact, which starts the Transmitter.

Transmitter. The Transmitter is the device which sends the fire alarm signals. It is arranged to send trouble signals different from fire signals, in order to show accidents to the wiring, or in case the battery becomes weak or disconnected. It is also arranged to automatically do the necessary electrical switching required to keep the system in condition to send a fire alarm signal even after a single trouble has developed in the wiring.

Test Coil. The Test Coil is used to periodically test the condition and efficiency of the device and installation. It consists of a brass shell upon which a proportionate length of Tubing has been tightly wound. The inner diameter of the shell is just large enough to permit of inserting a test plug. This is electrically heated and heats the test coil, causing an expansion of air, and making a test which is identical with an actual small fire. The use of the test plug and coil shows that the Tubing and the system is intact.

Advantages. The advantages claimed for the Compensating type of Automatic Alarm are, that the system has no moving parts distributing throughout the building, and therefore is not subject to the defects which are part of regular thermostats. The system is not readily subject to injury from malicious tampering. Its operation is not interfered by the painting or whitewashing of the tubing, and it sends an alarm quicker than any other Automatic Alarm System.

CHAPTER XXI.

COMMUNICATIONS AND THEIR SAFEGUARDING.

IN the practice of Fire Prevention, the making of an individual building safe against fire is one problem. The making of two adjoining buildings, which are connected or communicate with each other is another problem. Its importance is almost self evident, because if two buildings are connected, it means there is an open passageway for fire to travel from one building to another. In other words, a fire in one building must be considered as a fire in two buildings and the destructiveness of fire is an arithmetical or geometrical progression, and the moment that a fire extends from one building to another building a crisis is reached and a conflagration is under way.

The passing of fire from one building to another applies with equal force to the passing of fire from one section or division of a building to another section or division of a building. What constitutes a division or section of a building from a really practical fire standpoint is the presence of a good brick wall, which can be considered a fire wall or division wall. As previously stated, such a wall should extend from the basement through and to the roof, and if there are any openings in it, these openings must be effectively stopped or closed in case of fire.

Classes of Communications.—Communications in the sense that Fire Prevention uses the term is applied to any opening in the walls of a building which would favor or permit fire to travel from that building to the adjoining building.

Communications, as a Fire Prevention term, is also used to describe any passageway which connects one building with another.

Wall Openings.—Doorways.—The most common form of communication is a doorway in a party wall or in two independent walls, which is used to permit easy passage from one building to another in the ordinary course of business or whatever use is made of the buildings.

Belt or Shaft Holes.—Another form of communication that is fairly common is a hole or opening in the brick walls through which a belt or shaft is run for the purpose of communicating power from an engine room or motor room in one building or section of a building to machinery in another building or section of a building. An opening similar to belt and shaft holes is a hole made for pipes or wires.

Windows.—Another form of communication sometimes met with is a window in the independent wall of another building. In some cases, these opposite windows are very close together, if the independent walls adjoin. In some cases, the windows are several feet apart made so by the fact that there is a court or a shaft of some kind between the two buildings at the point where the windows are placed.

Windows in this position are sometimes treated as a case of exposure rather than commmunication. There is no fixed rule determining this, it being a matter of practice in various insurance districts or territories, at what number of feet to draw the line between opposite windows, which constitute exposure or communication.

From a theoretical standpoint the fact that there is a separation between the walls of the two buildings could be construed as making exposure and not communication, for the reason that communication in the distinct application of the term is taken to mean an opening in the wall between two adjoining buildings. If the walls do not adjoin at the place where the openings exist, then the definition of communications is not complied with, and the condition becomes one of exposure.

From a practical standpoint, however, if the distance between two opposite windows is only a matter of a few feet, say, less than five feet, it must be admitted that a fire of any size and extent would pass from one building to another building through these opposite windows almost as quickly as if the walls adjoined.

Wood Beams in Party Walls.—Another form of communication that fits the definition of communication as an opening in the walls which would permit fire to travel from one building to an adjoining building is the case where wood beams rest on party walls without brickwork between the ends of the beams. The practical effect of this arrangement of the beams is that the burning of the ends of the beams in one building would mean the burning of the ends of the beams in the other building, and, therefore, communicate or transmit the fire to the second building.

No Fire Wall.—A condition that is very similar to this exists in the case of adjoining buildings which have no fire wall or parapet wall at the roof. In such a condition, the two buildings are practically open to each other at the point where the roof beams are laid, and also, because the roof boards are continuous across the party wall. The result of this condition is that a fire which reaches the top floor or gets into the roof space of one building quickly burns across to the adjoining building.

Cornices.—The communication by roof beams or roof boards made by the absence of a parapet or fire wall may exist in a lesser degree by the cornice being a boxed cornice and continuous with the cornice of adjoining buildings on either side. In this case, a fire, which reaches the roof space or cornice of one building, would quickly extend to the cornice of an adjoining building, and, as cornices, which are thus continuous, are seldom cut off or fire stopped from the roof beams or roof space, the fire would, as a result, extend to the roofs of the adjoining buildings.

Passageways.—Bridges and Tunnels.—The type of communications, which consist of passageways, connecting one building with another building is limited principally to bridges and tunnels.

Bridges.—The bridge particularly does not carry with it the liability of communicating fire from one building to another in any thing like the degree that openings in adjoining walls would do. From a theoretical standpoint, a wooden bridge might be expected to extend fire, because, if it caught fire and burned its entire length, it might set fire to doors or windows in the vicinity of its terminal. In the case of an iron bridge, this result is much more improbable.

Tunnels.—Tunnels, as communications, are likely to represent a source of communicating or transmitting of fire. They are very likely to pass smoke from one building to another provided the floors or sections of the building with which they are connected are smoke filled or on fire. The probability that they would pass heat or flames depends on the conditions. If the tunnels are of some length and of incombustible construction, there seems little likelihood that they would pass sufficient heat or flames to start fire in the building or section of a building with which they are connected. If they are of combustible construction, or contain combustible materials, or the rooms at their terminals contain inflammable or combustible materials, the chances of their spreading fire are increased.

TREATMENT OF COMMUNICATIONS.

For purposes of safety, the removal of the communicating openings or their effective treatment is necessary. There are two recognized methods of treating communications from the standpoint of effective protection. The first method is the closing of the opening by bricking it up or making the wall intact, and, therefore, doing away with the opening. The second method is to install fire doors of proper construction and operation.

Bricking Up Communications.—Bonded Brickwork.—The closing or removal of a communicating opening, to be properly done, must present brickwork at the opening of the same Fire Resisting value as the remainder of the wall. This means that no cracks should be left between the brickwork of the wall proper and the brickwork that is put in to close the opening. It is not sufficient to fill the opening with brickwork in a loose manner, but it must be put in place so that the joints are as air-tight as a section of any solid wall. The requirement is met by properly bonding the filled-in brickwork to the original wall. It is preferable that all the courses of brickwork should be bonded but in many instances, it is considered acceptable to have the interior vertical courses bonded, and leave the single outside vertical courses not bonded.

Cut-Offs or Fire-Stops.—A good brick wall, that is, a wall which is sufficiently thick and properly built in respect to the mortar and the joints of the brickwork is the best fire stop yet devised. But no matter how good a brick wall may be, if there are doorways or openings in it, the brick wall will let fire pass through as if there were no wall.

The use of iron doors was a natural thing to do because of the fact that iron was considered incombustible, and, therefore, should be a proper and effective fire-stop. This belief was sound enough in some respects, but the people who acted on the belief considered that they were dealing with flames or burning gases, and overlooked the effect of heat or heated air. They did not realize that heated air would pass through any crack or crevice of the smallest kind in sufficient volume and intensity to set fire to anything combustible within its reach, and they also overlooked the fact that iron is an excellent conductor of heat and in some cases will even start a fire, when near combustible materials, more quickly than the heated air itself under the same conditions.

The practical results of using iron in a fire door was that heat was freely passed through the opening, which the iron door was supposed to cut off, the iron itself became red hot, when attacked by a sufficient amount of fire, and the iron floor lost its flatness and rigidity and warped and bulged at the corners. The result was that flames passed through the corners and sides of the iron door and the expected fire-stop proved of little value.

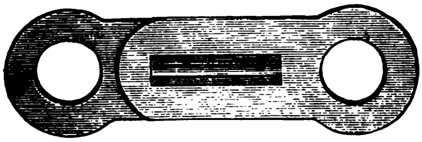
The failure of the iron fire door caused experiments to be made and strange as it may seem, the use of a wood door was found to be more satisfactory, and, in fact, when properly made, became a thoroughly efficient fire-stop.

The wood door, however, was a wood door covered with roofing tin. It was due to Edward Atkinson, the founder of the Mill Mutual System of Fire Insurance, that it was made a practical success. Atkinson's part in developing the tinned covered fire door was the drawing up of rules and specifications, which resulted in its proper construction in respect to the use of materials. He also invented an automatic method of closing the door, which was applied to sliding doors, the invention or development of this idea being attributed to Byron Weston.

Atkinson's automatic invention was the use of a lever released by the melting of fusible solder, and this invention was used not only in the automatic closing of doors, shutters, and hatches, but was applied to the construction of a valve for the conversion of a perforated pipe system into an automatic sprinkler system.

The fire door constructed on the principles of tin clad wood and an automatic closing by the use of a fusible link is to-day standardized and generally known as the Underwriter door because of its invention, development, and required use by Fire Underwriters.

Cut Offs or Fire Stops.—Where it is not practicable or expedient to close or remove communicable openings, the alternative practice is to install cut-offs or fire stops. These are fire doors in most cases, and are put in place at door-ways, shaft holes and entrance to tunnels and bridges. For window openings, shutters or wire glass windows are used, while for belt openings a metal box or hood is the only practicable thing yet devised.



CHAPTER XXII.

TIN CLAD FIRE DOORS.

FIRE Doors.—The term "Fire Doors" is used to describe doors of special construction and operation which are placed at communicating openings for the purpose of stopping fire passing from one building into another. As a general thing Fire Doors mean lock jointed, tin clad wood doors and iron doors. Ordinary doors of wood or wood covered with metal nailed on in a loose and careless manner are not considered as fire doors. Even iron doors in many localities are not considered fire doors because they are not recommended or approved by the insurance authorities having jurisdiction.

Standard Fire Doors.—What is very generally known as the Standard Fire Door is the door constructed according to the specifications adopted by organizations representing the Stock and Mutual Fire Insurance Companies. Doors which vary to a greater or less extent from these standards are also manufactured and installed in different localities so it is not practicable to describe these non-standard doors in detail. The following digest of the Standard adopted by the National Fire Protection Association and published by the National Board of Fire Underwriters will serve to describe the essential features of fire doors and also be useful as a guide in determining wherein non-standard doors differ from standard doors.

Materials.—The materials used in connection with fire doors comprise wood, tin, and iron or steel for the hardware or fittings.

Wood.—The core or inner part of a fire door is made of boards which should be well seasoned white pine or a similar non-resinous wood. The stock should be of a good, sound quality practically free from sap, pitch, moisture and large or loose knots.

The boards should be plain, not beaded, tongued and grooved, dressed on both sides and not exceeding eight inches in width. The finished thickness of the boards should be 13-16 inch full.

Tin.—The metal used for covering fire doors is either tin plate or terne plate, the latter being preferred.

Hardware.—The fittings and metal parts of a fire door, that is, the hardware is in most cases of wrought iron, but sometimes steel is used.

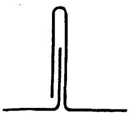


Fig. 1

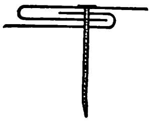


Fig. 2

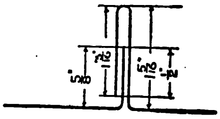


Fig. 3

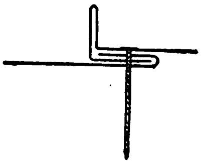


Fig. 4

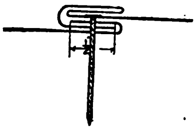


Fig. 5

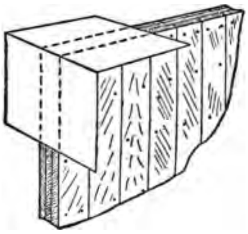


Fig. 6

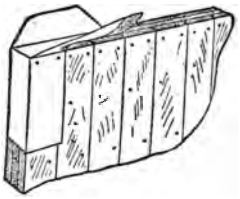


Fig. 7

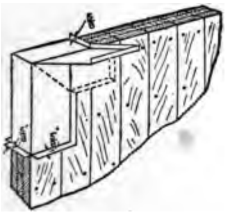


Fig. 8

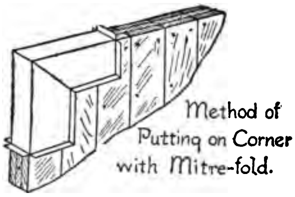


Fig. 9

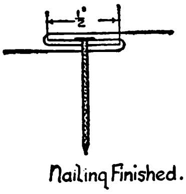
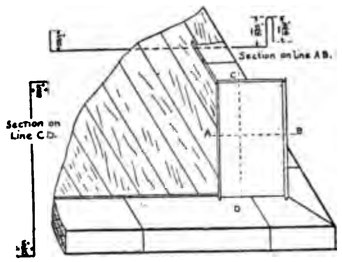


Fig. 12

CONSTRUCTION.

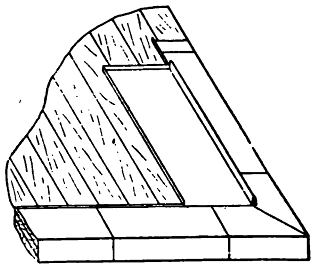
Wood Core.—Fire doors are made of two or three thicknesses of boards and called, therefore, double or triple batten doors. The layers or thicknesses of the boards are laid across one another. The outside layer or batten having the boards running in a vertical direction, and the inner layer or batten having the boards running a side or horizontal direction.

The layers or battens are fastened together by the use of wrought iron nails which are driven in flush and the points or ends turned in or clinched, so as to give the nail a greater hold.



First Position in Applying Side Sheets Showing Method of Bending.

Fig. 10



First Sheet in Position Showing Lower Horizontal Seam Finished.

Fig. 11

The nails are driven in rows, not exceeding eight inches apart and the outer rows are placed near the edges of the door.

All edges or corners of the door should be smooth and square.

Tin Covering.—The fire resisting value of a wood door encased in tin depends upon the exclusion of oxygen from the wood, thereby retarding or preventing combustion, and also, upon the degree to which bulging in the covering can be prevented when the door is exposed to fire. To obtain these results, the covering must be so applied that the joints between the plates will remain intact, but provision made for the escape of the gases generated from the wood core.

The sheets of tin are fitted together by a method known as lock jointing and nailed to the wood, by what is known as blind nailing. It is the method followed by tinsmiths in applying tin to a tin roof. A tin roof must have tight joints to keep out the rain and the tin sheets must be attached firmly in order to hold when the metal expands and contracts from the changes in weather.

In lock jointing tin sheets, the edges of two sheets that come together are doubled over. The upturned edge of one sheet is gripped in with the down turned edge of the adjoining sheet in just the same way that a person grips their hands together by locking the fingers of one hand underneath the fingers of the other hand.

This method of joining two sheets of tin together is what is called the single lock joint and is represented by figure 1, and figure 2.

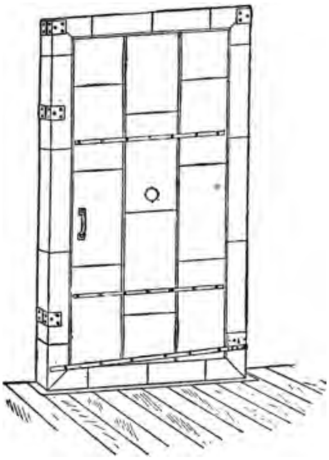


Fig. 13

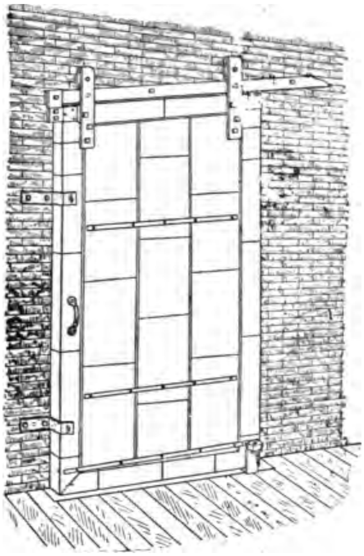
What is known as a double lock consists of turning the edge of one sheet up for a half inch and turning the edge of another sheet up for two inches and one-half; the large turn of two inches and one-half is then bent over again, so that one turn of the tin is 3-16 inches high and the other 5-16 inches high as shown by figure 3.

This makes a loop edge and this loop edge is fitted over the upturned edge of the other sheet and hammered down flat, and the remaining part of the loop edge turned upright as shown by figure 4, and next hammered down flat as shown by figure 5.

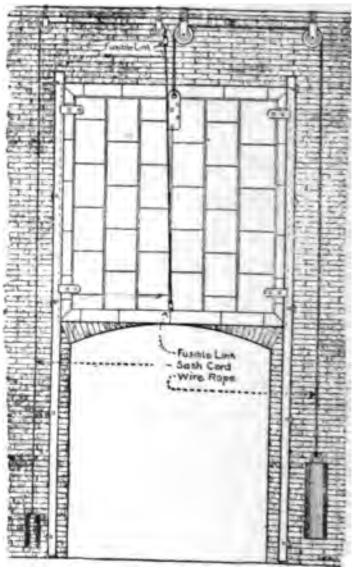
The difference between the two locks is that in the case of the single lock as shown by figure 1, the nail is driven through one fold of the tin and covered by three folds of the tin, while in the case of the double lock, the nail is driven through four folds of the tin and covered by two folds of the tin.

The blind nailing consists of nailing the tin and then covering the heads of the nails by the folds of the tin or the locking, thereby keeping the nail heads from being exposed to the fire.

In covering the wood core with tin sheets, the four corners are covered first. For each corner a whole sheet of tin is used and folded as shown by figures 6, 7, 8 and 9. Then the edges are covered with sheets of the same size or long strips, sometimes galvanized iron being used instead of tin, and these edge pieces are locked into the corner pieces with a joint and without the use of nails. Then the side sheets are applied, starting with first sheet at the right hand lower corner as shown by figure 10, which shows the sheet upright, and figure 11, which shows the sheet laid flat. All horizontal seams will appear like figure 12, except the last seam at the top of the door, which will be like figure 5. All vertical seams would be like figure 5. When the tinning of one side is completed, the door will appear like figure 13.



Sliding Fire Door



Vertical Fire Door

The nails used are No. 12½ or 13 gage flat head full barbed wire nails, two inches long. Five nails are used on each side and four nails on each end of the sheet, the nails being close to, but not at the corners. In laying the sheets an effort is made to have them as flat against the door as possible in order to avoid air spaces.

When the covering is completed, a small hole three or four inches in diameter is cut through the middle plate on the exposed side of the door, but not through the wood core. The tin around this opening is secured with small nails and the exposed wood thoroughly painted.

The purpose of this hole is to permit the escape of gases generated from the burning of the wood core, when the door is exposed to fire. These gases would otherwise cause the bulging of the covering and the rupture of the joints. This hole is usually made after the door has been mounted. For doors under fifty square feet in area, three inch holes are made, and for doors over fifty feet in area, the holes are four inches.

Fittings.—After the door is covered with tin, the fittings are attached for the purpose of hanging the door. These differ according to whether the door is a sliding door or a swinging door.

For a sliding door, hangers are bolted to the door with half inch special counter-sunk carriage bolts, with the heads of the bolts on the back of the door. For doors six feet or less in width, two hangers are attached, and for doors over six feet in width, three hangers are attached.

Two binders are attached to the door, one, about twenty-four inches from the top of the door, and the other, about eighteen inches above the sill.

Chafing strips are always attached. Two half oval strips ¾ x ¼ inch are attached to the back of the door and bolted through the door to two flat strips of the same length on the other side of the door which are 1 x ⅛ inch. At the bottom of the door a strip 1½ x ⅛ inch is attached to take the wear of the stay roller. The length of the half oval strips is 4 inches less than the width of the door, while the length of the lower chafing strip is five inches less than the width of the door. The ends of the half oval strips are chamfered so as to prevent catching onto the brickwork at the side of the opening.

The chafing strips on the back of the door are placed in position at ⅓ the distance from the top, and about 24 inches from the bottom, and are run parallel with the door track. The bolts in the half oval strips are ¼ inch with counter sunk heads and are spaced at not more than 9 inches apart, the end bolts being placed 1 inch from the ends of the strips. The stay roll strip is run parallel with the track and is fastened by 1¼ inch wood screws, which are spaced not more than 12 inches apart, and the holes are counter sunk.

A wedge is fastened to the door by one 1¼ inch and one 2 inch wood screw, and placed so that it is back of the stay roll when the door is closed.

Bumper shoes are attached to the door by 1¼ inch wood screws and placed opposite each bumper and each binder.

Handles are provided on the doors; on the back of the door it is a flush pull handle, which is counter sunk flush with the surface of the door. On the back of the door the handle is a heavy bow shaped handle. The handles are bolted through the door or otherwise securely attached.

For swinging doors hinges are attached. These are of wrought iron or steel 2½ x ⅜ inch which are bolted to the doors with 4⅜ inch bolts and which extend ¾ of the width of the door. In the case of doors which are more than 7 feet in height or 6 feet in width three hinges are provided.

The doors are secured by at least three lever bars, which are made of 1½ x ⅜ inch iron and which work together. The upper and lower lever bars are placed not more than 12 inches from the upper and lower edges of the door opening.

The door is arranged to be opened from either side by the use of a latch which swings on ⅜ inch bolts run through the door and provided with keepers and a spring to insure latching. The latches are arranged to enter catches, which are made of heavy wrought iron and built into the wall or bolted through it.

In the attaching of these fittings to the door, machine or carriage bolts are placed through the door and the heads of bolts rest against washers next the tin, while the nuts rest against the steel fitting. In the case of swinging doors in pairs, one of the doors is bolted at the top and bottom by ⅞ inch steel bolts, which are attached to the door by bolts driven through it. The door bolts into substantial metal strikes, which are securely fastened into the arch at the top and into the sill at the bottom. They are arranged to operate independently or together by the use of a handle at the center the same as is done for double swinging iron doors. The lever bars to the center catches are made of 2 x ⅜ inch steel and each catch is fastened by 2 x ⅜ inch bolts through the doors.

Openings.—The openings for fire doors should be studied in respect to size of opening, preparation of the walls, details of the sill, lintel, walls and jambs.

The openings should be as few in number as the business operations will permit, and the size and dimensions of the openings should be reduced as small as possible. At this point it is usual to adopt a maximum area, which is considered the limit for a standard opening.

The opening should be prepared for the installation of fire doors by the removal of all woodwork or wood lath furring about the opening, and should present a smooth masonry surface.

The sills are made of stone or iron or a combination of the two. A number of different ways of making fire door sills are in use and for purposes of explanation the following are given:

Concrete to the depth of 4 inches is laid between an angle iron at each side of the building. The angle iron is 3½ x 5 x ⅜ inch and extends past the opening at least 6 inches on each side. The long side of the angle is placed against the face of the wall and the short side extends out under the bottom of the wall as shown by figure. The angles are fastened together by ¾ inch bolts run through the wall and placed close to each side of the wall opening and not more than 18 inches apart. The bolts have nuts at each end.

Another form of sill is a concrete sill as just described, with the addition of a ¼ inch steel plate, which extends out flush with the outer edges of the angle irons on each side of the wall and is held in place by ⅜ inch counter sunk machine screws, which are spaced not more than 9 inches apart. See figure 14. The steel plate is checkered as this less likely to become smooth and slippery.

Another form of sill is concrete combined with angle iron and supported by brick corbeling. In this sill the concrete is made 3½ inches and angle irons are 3½ x 6 x ⅜ inch. The short side of the angle is placed parallel with wall and set out 4 inches from the face of the wall, while the long side of the angle is placed to extend into the wall. Where the angle iron extends beyond the bearing of the brick wall two courses of brickwork are corbeled out as a support, the upper course being set 1½ inches back from the perpendicular face of the angle as shown by figure 15. In the case of sills which will be used for heavy trucking, the concrete is increased to 6 inches, the angle

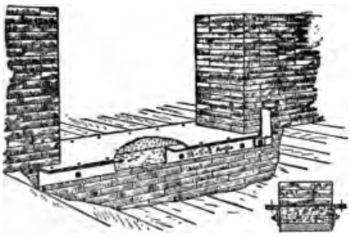


Fig. 14—Angle Iron and Concrete Sill, with Plate on Top

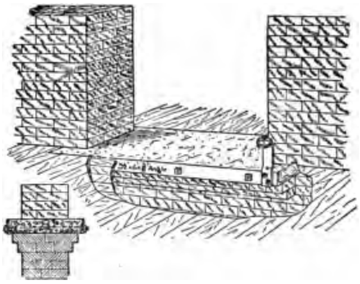


Fig. 15—Angle Iron and Concrete Sill, Supported by a Corbel of Two Courses of Bricks

irons increased in weight, and the brick corbeling increased by another course and carried out to the outer edge of the sill.

In the case of old walls where corbeling the brickwork is undesirable, iron (Z) bars are used in place of the angle iron and the brick corbeling. In this case the concrete is increased to 7 inches. The Z bars are fastened together by ¾ inch bolts, which are driven through both perpendicular faces of the Z bars and through the wall.

Another type of sill is made by placing a wrought iron or steel plate not less than ¼ inch on a concrete support not less than 6 inches on each side of the opening, and extend under a flush with the outer surface of the fire door. Where the concrete extends beyond the bearing of the wall it is supported by corbeling the brickwork for three courses.

The concrete used in the sills of fire door openings should be made of one part Portland cement, three parts clear sharp sand, and four parts clear broken stone, which will pass through ⅝ inch mesh. It should be thoroughly mixed, well tamped, finished smooth, and flush with the upper surface of the sill.

Sills should be raised in order to help prevent water from running through the door openings. The rise of the sills is from 1½ to 2 inches above the surface of the floor with an incline provided as a matter of convenience.

Lintel.—Brick arches are preferred for lintels but in some cases steel (I) beams are used, but these should be protected against fire. Stone and tin covered lintels are also used but they are not recommended.

Door Frames.—In some cases, it is necessary to put in a frame to carry the fire doors. This frame has jambs made of rabbetted 3½ inch angle iron ¼ inch thick and held firmly in place by at least ¾ inch bolts on each side of a passing through the wall as shown by figure 16. The lower end of the jambs is set into the sill at least 2 inches. The catches to hold the latches and the pin blocks which hold the hinges are made of heavy wrought iron and riveted to the iron wall by at least two ⅜ inch rivets. Another form of iron door frame is an angle iron set into a rabbet in the brickwork. The angle iron is 3 x 3 x ¼ inch and connected by 1¼ x ¼ inch bars, which are spaced not more than 24 inches apart as shown by figure 10.

Installation.—Sliding doors are hung on an inclined track, swinging doors are hung by the hinges to bolts in the brick wall, vertical doors are hung by the arrangement of balanced weights.

The track for a sliding door is made of flat rolled steel 3½ inches wide and ⅜ inches thick. Tyre steel or steel having rounded edges is recommended for this purpose, because it presents less resistance to the operation of the door. The length of the track is equaled to twice the width of the opening plus 21 inches in order to accommodate the door when in position at the opening and when in position away from the opening.

The extra 21 inches is made up of 12 inches, which is allowed for the lap and width of the door, 8 inches allowed for attaching the front and back bumpers, and 1 inch for clearance when the door is wide open.

The track is set at an incline of ¾ of an inch to 1 foot and is punched to receive the wall bolts in such a manner that when the door is closed each hanger which carried the door will be in place directly opposite a wall bolt thereby bringing the bearing more directly on the wall bolts.

In placing the track, a door is put in its proper position at the opening and supported by a ⅜ inch block between the sill and the bottom, and a ¼ inch strip on the upper edge of the door. The track is then placed in its exact position over the door and circles marked on the wall to indicate the holes for the track bolts. The front and back bumpers are also put in place when the track is bolted in position. The track should never be attached to a wood frame even if the frame is tin clad, and wood or lead plugs in the wall should never be used to support the wall bolts.

The punching of the track for the wall bolts is regulated by a table, which gives the size of opening, the length of track, the space for the various bolts.

In attaching the hangers to the doors, the position of the hangers is determined by placing them on the track directly opposite the wall bolts then marking the position where they come on the door.

The hinges of swinging doors are fitted either to a wrought iron wall eye or wall pin, which is set into the brickwork in various ways.

FITTINGS.

Swinging Doors.—Swinging doors are provided with at least three wrought iron hinges of 2 x ⅜ inch bar iron. The upper and lower hinges extend across the door as far as the panel frame on the opposite side. The center hinge extends at least one-half of the distance across the door. The hinge straps are bent over and doubled far enough to overlap the panel frame on the hinge side. The hinge straps are also riveted through the door and through the panel frame on each side.

The door is hung to the wall by hinge eyes at least 4 x 3 inches made of ⅜ inch iron or heavier fastened by at least ⅜ inch rivets. The hinge pins are of ⅝ inch turned steel.

Swinging doors are secured by at least three latches, which work together, and are made of 1½ x ⅜ inch iron. The upper and lower latches are placed not more than 12 inches from upper and lower edges of door opening.

The latches are arranged to be operated from either side of the door and to swing freely on a ⅜ inch pin or rivet. They are provided with proper keepers securely riveted on the outside of the door and with proper spring to insure latching. The latches enter catches made of ½ inch Norway iron securely riveted through the wall frame.

Double Swinging Doors in Pair and in Duplicate.—This refers to a pair of doors on each side of the wall. The two doors opposite each other, that is, one door on each side of the opening, is fastened together by hooks of ⅝ inch round iron or in place of this, bolts or spring catches are placed at the top and bottom.

The right hand door is arranged to fold over the left hand door and overlap at least 1 inch. In case the two doors are set flush, they are arranged to fit into a rabbet of at least ⅝ of an inch.

Sliding Doors.—Hangers are attached to sliding doors. These are at least two in number, of the antifriction pattern, and fastened to the door by at least four ½ inch machine bolts at each fastening.

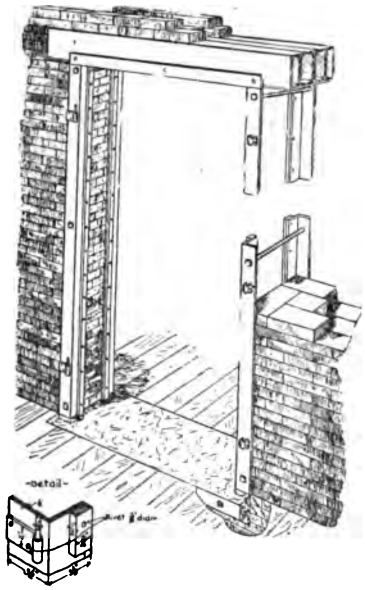
The wheels of the hangers are of cast-iron ¾ x 4½ inches and may be constructed with curved grooves so as to bear only on each edge of the track.

The wheels run on a track which is set in a channel at the top of the door opening. The track is ½ x ½ inch iron. The channel is formed by two angle bars 2 x ⅜ and 1½ x ¼ inches. At the bottom of the door opening is a similar channel. The channels are riveted or bolted to the wall frame and where they extend beyond the wall frame they are bolted to the wall by expansion bolts ½ x 4½ inches. The lower channel is extended on the side toward which the door opens at least 12 inches beyond the wall frame.

Sliding doors are arranged to overlap the wall frame at least 2 inches at the sides and at least 1 inch at the top and bottom. They are secured both in front and back by at least two lugs or binders on each side. These are made of ⅞ inch round iron, and when the door is closed, they pass through holes in the angle iron panel frame. The lugs are to be arranged so that they will bind the door to the wall frame when it is closed and latched. The lugs are riveted or bolted to the wall frame in such a manner as to prevent turning. The doors are also provided with a latch, which is made of 2 x ⅜ inch iron, and which fits into a catch and has a handle.

Sills.—The sills for iron doors are made of iron or steel and raised at least 2 inches above the floor on each side of the wall. If of plate iron or steel, the edges are fastened to an angle iron 1½ x 1½ x ¼ inch or heavier on the inner side of the wall frame. The sill rests on the brick wall and extends to the upper edges of the wall frame. In the case of a basement floor, the sill is of stone or concrete where the doors swing. In no case is the sill of wood unless the doors swing clear of the floor at least 6 inches.

Wall Frames.—Wall frames, which fit around the opening, for iron fire doors are made in two styles one style for overlapping doors and the other for flush doors. For the flush door, the wall frame must have a rabbet in which the door can set.



Iron Door Frame for Tin Clad Fire Doors. Useful when door openings are made after wall has been erected

The frames are made of angle iron 4 x 3 x ⅜ inch or of an iron plate 4 x ⅜ inch, which is stiffened by an angle iron 1½ x 1½ x ¼ inch riveted on the back. The latter type of frame is used for rabbetted doors, the angle iron being attached to theh plate in such a manner as to form the rabbet.

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The top and bottom pieces of the frame are joined to the side pieces by wide splice plates of 3/8 inch iron, which are securely riveted in place.

The frame on one side of the opening is connected to the frame on the other side of the opening by tie bars of 1 1/4 x 1/4 inch iron spaced not more than 24 inches apart around the entire frame except at the sill. In place of these tie bars, the frames may be joined by 5/8 inch bolts driven through the brick wall and spaced not over 24 inches apart.

When the angle iron frame is used, it is of advantage to use tie angles 1 1/2 x 1 1/2 x 1/4 inch at the upper corners.

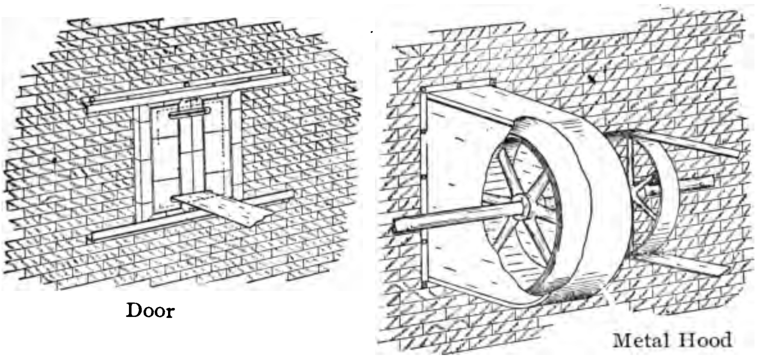
At the bottom of the opening the frames are set to project 2 inches above the floor, and in case of sliding doors, the bottom of the wall frame may be used as a lower channel for the door.

CHAPTER XXIII.

SHAFT AND BELT HOLES.

SHAFT Opening.—The approved method of closing or protecting a shaft opening through a wall is to brick up the opening around the shaft as close as possible and then filling the remaining space with cement so as to make a joint that is practically tight. The shaft, of course, should be turned before the cement has fully set.

Belt Openings.—Belt openings are closed or protected by the use of tin-clad fire doors or a metal hood. The metal hood is considered inferior to the fire doors and is only used when the doors are not practicable.



Door

Metal Hood

Protection for Belt Holes in Wall

Fire doors for belt openings are made of two thicknesses of 13-16 inch boards and otherwise according to the same rules for constructing and covering regular size fire doors.

They are arranged to slide in upper and lower guard rails or channels, which hold the door in place. These channels are made of angle irons 2¼ x 2¼ x ¼ inch securely riveted together and secured by ⅜ inch bolts through the wall. Z bars of proper dimensions are used in place of the angle irons if obtainable. The channels should be long enough to hold the doors when open. The doors should have suitable hooks and staples to keep them closed.

The metal hood used in place of sliding doors constructed of heavy galvanized iron and without the use of solder. It is arranged to fit over the belt and wheel with an opening for the shaft and is securely attached to the brick wall.

CHAPTER XXIV.

IRON FIRE DOORS.

IRON Fire Doors.—Iron fire doors are made of either iron or steel plates or of sheet iron or sheet steel with frames and bars of angle iron. There are two types of iron doors, the plate or vault pattern door and the sheet iron door.

The plate door is made of an iron or steel plate 3-16 inch in thickness.

The sheet iron door is made of number 12 gage sheet iron or sheet steel.

Doors are made to overlap the frame to which they are attached at least 1 inch on all sides. If the doors are set flush with the face of the wall, they are fitted into a rabbet at least ⅝ inch all around.

When the door is made of two plates or sheets, the joint is reinforced by a 3 x 3-16 inch strip or splice plate, which is securely riveted to each half of the door. The rivets on the splice plate are staggered and spaced not more than 9 inches apart.

The plate or sheet is strengthened by a frame with cross bars. For the plate door the frame is made of 2 x 2 x ⅜ inch angle iron, while for the sheet door the frame is made of 2 x 2 x ¼ inch angle iron. The frame is placed as near the edges of the door as practicable, and is made continuous with bent corners or with the corners reinforced by fillet angles where they join. The fillet angles are securely riveted in place.

The frame is stiffened with at least two panel bars and where the doors exceed 7 feet in height the panel bars are not to exceed 2 feet apart. The panel bars have the ends offset so as to extend over sides of frame or in place of this the ends may be fastened with fillet angles.

The plate or sheet and the frame are riveted together by rivets or Norway iron at least ⅜ of an inch in diameter, and spaced not over 6 inches apart. Steel rivets should not be used.

CHAPTER XXV.

OPERATION OF FIRE DOORS.

AUTOMATIC Arrangement of Fire Doors.—Fire doors are made automatic or self-closing by the use of fusible links and the combination of weights, which cause the door to close when the fusible links have been melted by the heat of the fire. The arrangement of the link and weights vary according to the type of door.

Automatic Sliding Doors.—The automatic closing arrangement for sliding doors should consist of at least one link placed above the door and near, but not in contact with, the ceiling. In addition, another link may be placed near the top of the door opening.

The links are to be so arranged that when they separate or give way under the heat a sufficient excess in weight will be exerted to draw the door past the opening and cause it to be latched.

The cord on the latch side is made of flexible phosphor bronze securely attached to the door. The cord to which the link is attached may be an ordinary cord.

The cord sheaves to be securely fastened to the wall with expansion bolts with bronze bearings and so constructed that the cord cannot jump the groove.

The weight on the side toward which the door closes to be inclosed in a suitable box to prevent molestation.

The latch should be provided withh a suitable coiled spring for holding it in place and to insure its fastening.

Automatic Swinging Doors.—The automatic closing arrangement for swinging doors should have the cords pass through holes drilled in the wall frame and arranged in sheaves, so that the fusing of the link will release sufficient weight to pull the door closed and latch it securely.

The fusible links should be placed near the ceiling and arranged so that the fusing of the link on either side of the wall will operate both doors. Several links may be used if desired.

The cords which are to close the doors should be sufficiently weighted to keep them taut when the doors are opened and closed.

When sliding doors are to be used provision is made for the installation of the stay roll. This is done by notching the upper face of the angle iron at one end at each side of the wall or the angles are drilled and ⅝ inch bolts installed.

Care and Maintenance of Fire Doors.—Fire doors should be ready for instant use at all times, therefore, it is necessary to keep the surroundings clear of everything that would be likely to obstruct or interfere with their free operation.

When necessary, a framework or slats should be built outside of sliding doors to prevent piling of stock, etc., against them.

They should be kept closed and fastened at night, and on Sundays and holidays, and whenever the openings are not in use.

Tin should never be tacked on a tin-clad door. When regular tin sheets become worn, new sheets should be substituted in the same manner as they were applied at first.

Tin-clad fire doors should not be painted unless it is necessary and not until they have been first given a coat of metallic brown, venetian red, or red oxide paint ground in pure linseed oil.

The following notice should be posted at each opening protected by fire doors, preferably stenciled on each side of the fire door itself: KEEP THIS FIRE DOOR SHUT.

Automatic Swinging Doors in Pairs.—These should be arranged so that the right hand door will fold over the left hand door. This requires the use of an automatic stop or trigger at the top of the doors, which will hold the right hand door sufficiently open to allow the left hand door to close first. The closing of the left hand door releases the trigger and allows the other door to close.

The left hand door should be provided with spring bolts or latches at both top and bottom, which can be operated from either side of the door by proper handles at the center.

Automatic Vertical Door.—The automatic closing arrangement for a vertical door has the cord connected with the fusible links attached to the lower part of the door and passes over pullies above the door with a weight attached to the other end. One link is attached to the bottom of the door and another link in the cord near the ceiling. The weight for the fusible link cord is less than the other weight, which is used to counterbalance the weight of the door. The counterbalance weight is attached by a wire cable and runs over pullies above the door. It is arranged to allow the door to close but is adjusted to prevent it dropping suddenly.

CHAPTER XXVI.

THE EXPOSURE DANGER.

EXPOSURE Analysed.—The occurrence of many conflagrations in the last ten years has caused emphasis to be placed on the difference between ordinary exposure and conflagration exposure. Ordinary exposure is the local or neighborhood exposure; it is made by the risks in the immediate vicinity, such as those that adjoin, or face the risk on the front or rear or on the sides. It is the exposure that can be foreseen or expected and to some extent measured or controlled.

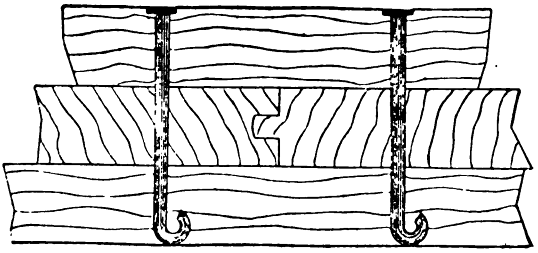
Conflagration exposure, or the conflagration hazard is the general or distant exposure. It is widespread, part of the community or environment and while sometimes capable of being located in certain sections, is difficult of application to individual risks. Conflagration exposure as a matter of fact is simply an extension of local exposure. Once a fire has spread beyond the buildings directly exposing the original building, a conflagration exposure has materialized. It means that a group of buildings instead of a single building are making the exposure. What this group exposure will do is beyond any practicable measurement. Conflagration exposure is in effect secondary, indirect or communicated exposure.

An exposure consists of the danger that one risk makes for another risk, or it follows that a risk exposes a risk and in turn is exposed by it. That is to say, exposure is mutual or counteracting. In the same way, a risk that is exposed by another risk and also exposes another different risk, transmits some of the danger of the second risk to the third risk. Exposure is therefore, common or interacting.

The elements of exposure are the conditions or factors that favor or obstruct the passing of fire. It is a matter of common sense reasoning that a dangerous risk means danger to a nearby risk; that it means more danger to its neighbor than they mean to it. In other words, exposure is based on the principle that fire danger is relative and depends on the degree of danger of fire that risks possess. The relative danger of one risk to another is therefore assumed. What is desired is the formulating of exposure in its details.

The principal detail of exposure is the space between risks. In the case of front or rear buildings, this is usually a considerable number of feet, depending on there being a street, alley or yard between the risks. In the case of adjoining risks there is likely to be no space and the walls of the buildings close together if not actually one wall. It is customary therefore to classify exposure as separated exposure and adjoining exposure.

Separated exposure has for its basis the clear space between buildings. In proportion to this increasing or decreasing, the exposure danger increases or lessens. At one hundred feet, the exposure is considered to be negligible. At ten feet, the exposure is considered so acute that both buildings are considered as one risk and should have the same rate. The factor of distance is modified by a number of circumstances. A solid brick wall without any openings is of great value in reducing the anticipated effect of fire, because it is evident that fire would not enter with the same rapidity as if there were openings in the wall. If both risks have blank walls facing each other, the condition is still more advantageous, and in fact represents an ideal condition so far as structural features are concerned. In a similar way, the degree of oppositeness is a favorable factor. If the risks expose each other at an angle instead of directly facing, there is less likelihood of a fire doing damage. If the wind were blowing away from the direction of the risk, this combined with the angular position would be a great factor in saving the risk from being subjected to the attack of the fire. Conversely, if the wind were blowing towards the risk, the angular position might be disadvantageous, for it might mean the risk receiving the effects of the fire.



CHAPTER XXVII.

FIRE SHUTTERS.

FIRE Shutters.—Fire shutters are made in three general types. Tin-clad shutters, iron shutters, and rolling iron shutters. The tin-clad and iron shutters are usually placed on the outside of window openings, while rolling iron shutter is more often placed on the inside.

Tin-Clad Shutters.—Tin-clad shutters follow the same general lines as tin-clad fire doors. It is usual to have them made of only two battens or thicknesses of 13-16 inch boards and these are laid at right angles.

Tin covering is applied to shutters the same as to fire doors except that the seams should be made with the upper sheet lapping outside of the under sheet for the purpose of shedding water.

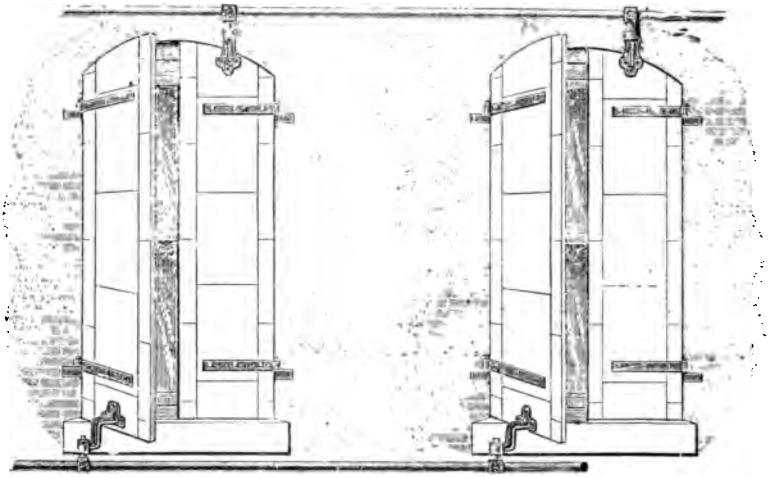
The nails used are 1¼ inches long and otherwise are the same as used for fire doors. When the shutters are made in pairs, the edges, which come together, should be slightly beveled, but not rabbetted, in order to allow the shutter to be readily opened and closed, and to aid in making a tight fit. The fact that there is a joint between a pair of shutters does not make the protection afforded as reliable as a single shutter, which, of course, has no joint. This joint between a pair of shutters is sometimes protceted by attaching an iron edge or astragal of ¼ x 2¾ inch iron, which is bolted to one shutter by carriage bolts spaced 10 inches apart.

The shutters should be hung next to masonry and either overlap the window opening 4 inches or fit close inside the opening. They are hung by wrought-iron hinges 5-16 inch x 1¾ inches, which are secured by bolts passing through the shutter with washers under the bolt-heads. The hinges with wrought-iron pin or eye blocks, which are securely set in the wall or bolted through. When the shutters shut, they are secured by at least two 1½ x ⅜ inch steel latches, which are spaced about one-half the distance from the top and the bottom of the window opening and arranged to work together. The latches pivot on ⅜ inch bolts, which are fastened through the shutter. The catches, which hold the latches, are provided with a flare and fastened to the shutter by two through bolts.

Fire shutters are arranged to be opened from both sides. This is done to the extent of having at least one shutter in three on each floor above the first and below the seventh, as well as shutters, which are next to fire escapes and above adjoining buildings, can be opened from the outside by handles that can be operated by hand or by spike-pole or fireman's hook.

Sliding shutters outside are not advised, but if used, metal shields should be provided to prevent the accumulation of snow and ice upon the track.

Iron Shutters.—Iron shutters are made of number 14 gage sheet iron or steel, and provided with an angle iron frame. The frame is 1½ x ¼ inch and stiffened by at least two cross bars of the same material. In the case of shutters over six feet in height, cross bars are placed at not more than 2 feet apart. Continuous welded frames and cross bars of 1½ x ½ inch iron are often used that are not considered the full equivalent of the angle iron frame. The welded frame is often necessary when folding shutters are used.



Row of shutters operated and fastened, opened or shut, from one window

The shutters overlap the wall at least 1½ inches all around, or if it is not practical to have them overlap, the bottom of the shutter should be made to fit the sill closely while the frame should be within the wall opening when the shutter is closed.

The shutters are hung by wrought iron hinges 2¼ inch which extend at least ¾ of the way across the shutter and are placed not more than 2 feet apart when the shutter is over 6 feet in height.

The hinges are fitted to pin or eye blocks which are securely set in the brick wall when the building is being erected. In the case of finished buildings, the blocks are set in holes drilled in the brickwork, and fastened with iron wedges set in cement. The pins are ½ inch round iron.

The rivets for iron shutters should be of iron at least 5-16 inch in diameter and spaces not more than 6 inches apart. Hooks or gravity catches should be placed in the wall to hold the shutter open.

Shutters should be arranged to be opened from the outside to the extent that at least one shutter in three on each floor above the first and below the seventh, next to fire escapes, and above adjoining buildings can be opened from the outside with handles that can be operated by hand or by pike-pole or fireman's hook.

Iron shutters should be thoroughly painted with two coats of iron oxide and boiled oil or equivalent.

Fire shutters should be ready for instant use at all times, therefore, it is necessary to keep the surroundings clear of everything that would be likely to obstruct or interfere with their free operation.

They should be kept closed and fastened nights, Sundays, and holidays, and whenever the openings are not in use. All parts should be kept thoroughly painted.

Steel Rolling Shutters.—The construction and operation of this device is the same whether for closing a window, that is, as a shutter, or for closing a doorway, that is, as a door. Their use is not considered advisable where tin-clad fire doors and fire shutters can be employed, but they are recommended for front and rear openings with exposures across narrow streets or alleys. The openings, which they protect, should be treated according to the same rules laid down for communicating and exposure openings in general.

A steel rolling shutter consists of the shutter proper or curtain and shaft or roller upon which it is wound, and covered with a hood and grooves at the side of the opening in which the curtain runs up and down. It is operated by a spring counterbalance chain or screw gearing, which can be worked by one person.

Curtain.—The curtain or shutter proper is a sheet of galvanized steel not less than No. 24 U. S. gage. It is provided with wearing strips at the edges and the upper edge is reinforced by one or two 1 x ⅛ inch iron strips securely riveted on each side. The bottom of the curtain is reinforced by an angle iron at least 1¼ x 1¼ x 3-16 inch or its equivalent, which is securely riveted on. One web of the angle extends into the groove at each side.

For larger curtains, the bottom should be reinforced in addition to the angle iron by plate iron strips at least 3 inches wide and at least ⅛ inch in thickness. The strip and the angle iron are commonly called the bottom bar of the curtain.

The curtain is fastened to the spring barrels or roller by machine screws or bolts. It should be retained in the grooves in such a manner that the opening will be completely covered and this necessitates placing the coil well above the top of the opening. It should extend into the grooves at the side at least 1½ inches.

When the curtain is equipped with a spring balance or where it can uncoil of its own weight when subjected to heat, provision should be made to support the curtain in a closed position independently of the spring balance.

The brackets which support the curtain should preferably be of wrought-iron or steel, and securely bolted to the wall. Where cast-iron brackets are used, they should be protected by the brickwork or made of such form as not to be subject to severe breaking strain.

The use of cast-iron brackets is questionable, particularly, where the curtains are large and where they are directly exposed to heat and rapid cooling by the application of water.

The lugs, which support the shaft, should preferably be of steel, and securely riveted or bolted to the brackets. If of cast-iron, they should be extra heavy.

The lugs should present broad bearing for the shaft or bearing pins with ample allowance for a reasonable amount of expansion or sagging of the shaft.

The shaft or roller should be of steel having sufficient strength, when heated, to carry the weight of the curtain without excessive sagging. Shaft or bearing pins should be of steel retained in the roller and brackets in a substantial and secure manner. Spring barrels may be of cast-iron.

This rule necessitates that the diameter of the shaft or roller be increased with the width and weight of the curtain.

The grooves, in which the curtain runs, should be of steel at least 3-16 inch in thickness, preferably in one "U" shaped piece. They should be securely riveted or bolted to a suitable angle iron for attaching to the wall.

When the grooves are built up, the parts should be securely riveted together, care being taken, to provide against the separation of the members when in a heated condition. Grooves of this character are more liable to buckle, when subjected to severe heat, than the single piece grooves.

They should be securely but loosely bolted to the masonry by through bolts or expansion bolts carefully installed or to structural iron at the wall opening. Wall bolts should be spaced not to exceed 18 inches apart. The grooves should also be securely bolted to the brackets unless the upper wall bolts are close to them.

Where possible, the grooves should be so installed that they will be protected by the brickwork or other fireproof material. The holes in the wall angles should be at least twice the diameter of the wall bolts and covered by washers under the heads of the bolts.

To be at least ½ inch deeper than the amount the curtain enters the groove so as to allow for expansion.

The hood, in which the shutter is coiled, should be of at least No. 24 U. S. gage galvanized iron and so constructed that it cannot be easily bent or damaged to such extent that it will interfere with the operation of the curtain.

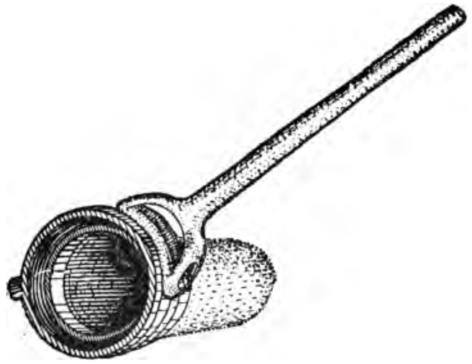
It should be securely fastened to the wall at the top and to the bracket at each end.

If installed outside, care should be taken to secure the necessary weatherproof qualities.

It should fit the curtain as closely as possible on the under side.

Where the hood is on the exposed side, the flame may pass up under the hood and around the coil. For this reason it is important that the curtain fit the wall opening closely, as specified.

All parts of the shutter should be kept thoroughly painted with best mineral paint or with graphite paint thinned with linseed oil. To facilitate moving of the curtain and reduce the friction, the grooves and movable bearings should be kept well greased.



CHAPTER XXVIII.

FIRE RESISTANT WINDOWS.

WIRE Glass Windows.—The window as a fire problem has two separate phases; one made by the outside or exposure fire; the other made by the fire within the building. The latter is generally overlooked, and for the present, its importance is overshadowed by the conflagrations in Baltimore and San Francisco. The widespread fire conflagration represents, first, an exposure fire on an immense scale, and secondly, a situation wherein buildings are practically left to offer such resistance as their structural design and materials are capable of.

Window protection at present follows two methods; one, the making of the window itself fire resistant, and the other, the use of a shield or guard to prevent the heat or flames reaching the windows. Under the first method, the most common means employed is wire glass in fire resistant settings, while the second method uses shutters or a water curtain. From another aspect the methods might be considered as the use of construction materials and the use of water.

The shutter as fire protection for windows is a natural evolution of its use for general window protection. For fire purposes it seemed sufficient to make shutters of iron, a material which did not burn, instead of wood, a material which did burn. The use of iron as a fire stop is fundamentally wrong and is due not so much to the lack of fire knowledge as to a lack of fire thought. It is not that people do not know better, but that they do not think about the matter. The common manifestations of fire are smoke, heat, and flames. In respect to fire starting or spreading, most people, not excepting many who are engaged in fire work of one kind or another, consider simply the flames. The one idea they act on is to guard against the flames, forgetting that heat will do exactly what flames will do, only more slowly. This oversight of what heat does is exemplified particularly in the use of the iron shutter. Everyone knows that iron gets hot quickly, and throws out or radiates heat freely. Thus it should be plain that an iron plate such as the shutter is made of cannot be a fire stop of much value. It will prevent the direct entrance of flames, but only for a short time, for when sufficiently heated, the iron plate curls and bulges at the sides and corners, and openings are made for the entrance of flames. Before this has taken place, however, the heat has passed through the shutter, set fire to the window casings and anything burnable near the window, with the result of making the iron shutter useless as a fire stop. Thus the iron shutter does not necessarily stop the flames or keep out the heat, but if anything assists its passage into a building. It has failed in numberless instances, and the conclusion that it is of little or no use is undoubtedly justified by experience.

The failure of the iron plate, both for doors and shutters developed the use of a wood core with a tin or lead plate covering. The core is two or three layers of tongued and grooved boards, and the covering is sheets of tin or lead plates fitted together with locked joints after the manner of tin roofing. The idea of the tin-clad wood is that the tin covering protects the wood from burning, because being airtight it excludes the oxygen of the air, which is necessary for the wood to burn. In practice this is not accomplished, because it is not practicable to cover the wood so tightly as to exclude the oxygen, and even if this were done, it would defeat its purpose, because the heat passing through the tin acts on the wood and causes what the chemist terms destructive distillation, or in plain terms the release of gases, which, if they do not find an outlet, burst open the tin and expose the wood. Although the wood core burns, the door or shutter none the less fulfills its purpose as a fire stop, for the side not directly attacked by the fire remains intact and keeps out the flames and heat. The record of lock-jointed tin-clad wood leaves no doubt of its efficiency as a fire stop and its established ability to resist the penetration of heat has made it a recognized protection for openings. It must be considered, however, that what is true of the standard door cannot be claimed for the standard shutter unless this is also made in duplicate. Duplicate tin-clad fire doors have been known to hold fires of the greatest intensity, but this result is not expected with single doors nor with single fire shutters. If the latter are made in duplicate; that is, a shutter on the inside and a shutter on the outside of the window, there is little doubt that this protection would successfully resist a conflagration, but such dependence cannot be placed on single shutters.

Shutters, irrespective of construction, have many practical objections and under any circumstances their use is decidedly limited. They are not feasible for a large majority of buildings because they are not ornamental, and most property owners refuse to mar the appearance of their buildings for the sake of fire protection. Even in the case of manufacturing and mercantile buildings where shutters are used, they are placed only in the rear or on such sides as are considered to be directly exposed. Moreover, they are dependent on some one closing them, and all too often are found open when the fire comes. As something outside of the building proper and not necessary for the daily use of the building, they are likely to receive little or no attention. At the same time on account of exposure to the weather, they need considerable care but do not get it, with the result that their usefulness is considerably impaired, if not practically destroyed. Furthermore, when closed, they shut up the windows and thereby prevent the discovery of fire from without, and as they are seldom arranged to be opened readily, they delay the firemen in entering buildings, as well as in the work of ventilating, a point of great importance in fire department work. These objections probably explain the general neglect of window protection, for until an improvment on shutters was devised, it was not feasible to provide complete window protection. The needed improvement has been supplied by wire glass, which has the distinct and special value of making it practicable to fortify a window against fire without interfering with its normal uses furnishing light and air.

Wire glass was invented to prevent breakage, and its use as a fire stop is an after thought. It is well-known that comparatively little heat is needed to shatter ordinary window glass, and when this is done, the window provides an unobstructed opening for the entrance of heat, smoke and brands, which is what makes window openings so much of a fire factor. Wire glass of good quality, on the other hand, is not only made to resist high temperature but the wire mesh holds the panes in place and it acts as a fire stop even when cracked by the heat. As the melting point of good wire glass is approximately 1800° Fahrenheit, it results that for all practical purposes it is no longer a question of how long the wire glass will resist fire, but how long the frame and sash containing the glass will resist fire. The result of tests and actual fires demonstrates that good wire glass will outlast its setting, which means that the frame and sash become of the greatest importance.

When an ordinary non-fireproof window is attacked by fire, the first result is the breaking of the glass, which falls out; and next the wood sash and frame takes fire either from the flames direct, or from the heat. It thus follows that the use of wire glass in a wood frame provides against the glass immediately falling out when attacked by fire, but once the wood frame begins to burn, it ceases to hold the glass pane in place, which then drops out and the condition is as bad as if wire glass had not been used. The moral of this is that if good results are to be obtained, a wood setting cannot be used to hold wire glass, and that there must be used a more fire resistant material.

This necessity has been met by the use of frames which provide a high degree of fire resistance for windows, and from a structural stand-point, they practically solve the problem of making a window opening fire resistant.

Details of Wire Glass Windows Construction.—The principal parts of Wire Glass Windows are as follows:

Frames, Sash, Materials, Types, Glazing, Automatic Operation and Prism Glass Frames.

Frames. The Frame is the construction which holds the Sash or window proper, that is, the window box.

Sash. The Sash is the construction which holds the glass, that is, the window proper.

Materials. The Frames and the Sash of Wire Glass Windows are made of galvanized iron copper, wrought iron, angle iron, kalamine, or metal covered wood and asbestos, or other special composition.

Types. Frames and Sash are generally made in two classes. One hollow metal and the other solid. The hollow metal windows are usually made of galvanized iron or copper, while the solid windows are made of wrought iron, angle iron, kalomine or composition. The Sash of Wire Glass Windows are made in the following forms:

Stationary, that is, windows that are not intended to be opened; Sliding Sash, that is, the ordinary up and down window in most common use; Horizontally Pivoted, that is, arranged to be opened in a horizontal position; Vertically Pivoted, that is, arranged to be opened in a vertical position; Hinged or Casement Windows, which are arranged to swing open like an ordinary door.

Glazing. The glass used in Wire Glass Windows contains a wire mesh, and is at least one-quarter of an inch thick. It is customary to limit the size of the pane or sheet of glass to 720 square inches, but not extending 48 inches in either dimension. In setting the glass into the Sash, it would have a bearing or depth of at least five-eighths of an inch. In some cases, two sheets of glass are placed in the windows, what is called double glazing. This is used when the exposure is extra severe and double protection is desired for the window opening.

Automatic Operation. Wire Glass Windows are arranged to close automatically in case of fire, by holding them open by attachments which contain a fusible link. The customary arrangement is to pivot the window above the centre, so that when the fusible link melts, the under part of the window being heavier than the upper part, the window automatically swings shut.

Prism Glass Frames. Prisms installed in windows for the purpose of improving the light in the building have some measure of fire protection, provided the frames are constructed to withstand the attack of heat and flames.

CHAPTER XXIX.

HOW TO INSPECT A BUILDING FOR FIRE PREVENTION.

INSPECTING a building for Fire Prevention is one of those practical things that must be learned by experience. It is a matter of training one's self to observe things, to described clearly and concisely what one sees, to distinguish between important things and unimportant, to recognize conditions when they are presented and to be competent and painstaking in hunting out the desired information.

Skill in these things comes from practice and experience, and a few inspections made with a capable and experienced inspector are worth very many printed lessons. There are a number of practical suggestions that can be given in a book of this kind, and the observance of these suggestions will carry a new inspector a long way and save him from many mistakes and embarrassments.

The first suggestion for the Fire Prevention inspector is: Do not quarrel with the occupants. Even though you have the fullest legal authority to enter a building and inspect it, it is better not to use this authority, unless it is absolutely necessary and unless your chief directs it. In the majority of cases, the occupants of buildings are obeying the law or are trying to obey the law as far as they can, and it should be the business of the inspector to co-operate with them and try to educate them to a better knowledge of Fire Prevention.

On entering a building or the premises of a tenant, the best course is to ask for the manager or person in charge and say to him; "I am an Inspector of the Bureau of Fire Prevention and I wish to inspect your place." In most cases permission will be willingly granted and the manager will afford every assistance to the inspector. If permission is refused or any obstacles are placed in the way of the inspector, the best course of action is to inquire the name of the person, or by whose authority, the permission is refused and then report the circumstances to the Chief.

In some instances this polite method will not answer, and where the chief directs it, or circumstances warrant an authoritative inspection, the inspector should be careful to show his badge of authority and his order to inspect the building, and also inform the occupants the section of the law which gives him the right to enter buildings.

Another suggestion of great practical value is: Make friends with the engineer, janitor, superintendent or other person in charge of the building. These men know more about the real condition of the building, than even the best inspector can find out; they are usually ready to help an inspector, and if approached by the inspector in a courteous way, they will furnish all the information that the inspector desires.

Another practical suggestion to inspectors is: Examine the building from the street before entering it, and if possible, walk all around the building in this way. Many inspectors who have neglected to "size up" the building from the street, have had cause to regret it. Such a street view of the building, will give some details as to the height, area, kind of construction, fire escapes, exits, exposed windows, number of tenants and character of their business.

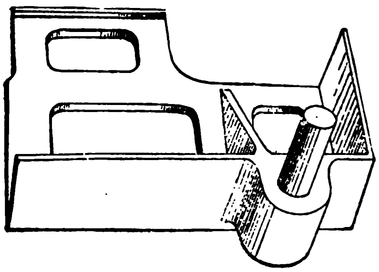
Another practical suggestion is: Begin the inspection of a building at the roof. The reason for this is not merely that it is easier to walk down stairs than to walk up, a small thing in itself, but which counts in an all-day inspection tour, but by starting at the roof, the inspector can locate most, if not all, of the floor opening shafts. In modern buildings all of these shafts now pierce the roof; in addition, other things can be noted, such as division walls, extensions and additions, fire escapes and the exposure from surrounding buildings.

In passing through a building, it is well to make the inspection notes in such a way that what the inspector sees on each floor, or in each tenant's premises, is clearly and distinctly separated, so that in reading over the notes afterward, the inspector will be certain of what he did see on a given floor.

It is assumed of course, that inspectors are using note books, because this is the only proper way to make inspection notes. Using loose sheets of paper or depending entirely upon the report blank is very bad practice. In the course of inspection experience, it will be found that questions regarding a certain inspection or a certain report will arise, and if the inspector has not kept his memoranda or is depending on his memory, he will have some difficulty in answering the questions. The use of a loose leaf note book is of course the best; after an inspector becomes used to a note book, he will find it an aid to make his inspections in a systematic manner and also making his notes in a systematic manner.

In making inspection notes, every inspector more or less invents a shorthand system of his own, that is, he uses certain abbreviations or certain marks or symbols, which are a labor and time saving device and which he perfectly understands. This is a good practice, of course, but it should not be carried to an extreme, so that after an inspector leaves a building and wishes to write out his report, he finds his notes insufficient. This is a mistake that new inspectors should guard against, and they will find it better to make very complete notes, or if they use their own shorthand system, they should standardize it and keep the marks or abbreviations in their note book.

A particular thing inspectors are advised to guard against is the least suspicion or suggestion of "Graft," even in its simplest form. The friendly cigar, or other small article pressed upon inspectors by many tenants should be rigidly declined. In most cases it is offered in good faith, but once in a rare while, it will be used to put the inspector in a bad light, and the man who has had only strictly business dealings with an occupant or owner is in the best position to make statements in case trouble arises.



CHAPTER XXX.

CLASSIFICATION OF BUILDINGS BY CONSTRUCTION.

DEFINITION.—A Building is sometimes defined as a structure with four walls and a roof. It is customary to describe buildings according to their type of construction, for example, Frame, Brick, Stone, Iron, Mill Construction, Slow Burning and Fireproof.

Frame Building.—A Frame Building is one built entirely of wood, that is, the walls, the posts and the beams are of wood; the partitions and the finish of the building may also be of wood or wood lath and plaster. The upright supports for the outside walls, called studs, are sometimes filled in with brick, when it is called a brick-filled building or brick-nogged building. This is different from a brick and frame building.

Brick and Frame Building.—This is a building which has wood walls, with a brick wall outside, what is sometimes called a brick veneer. In some cases a Brick and Frame Building may have one or more of the walls of frame construction, while the others are of brick construction. In most cases, it is the front wall which is brick, but in some cases a side or rear wall will be brick and the rest frame or wood. If a building happens to have three of its walls of brick and only one wall frame, the building might properly be considered a brick building, but special attention should be called to the one wood or frame wall.

The thing which decides whether a building is brick or frame is the walls proper, or the frame work of the walls. For example, a building which has outside walls of plaster or cement attached to a wood frame, should be considered a wood building, but for purposes of description it should be called a frame and plaster building. The same rule holds when a wood frame is covered with iron as is done with sheds, while many piers are built with an iron frame and a wood covering.

Brick Building.—A Brick Building is one with brick walls. As a general rule, a brick building means an ordinary non-fireproof building, that is, the floors are built with ordinary wood beams or joists, the partitions are ordinary wood lath and plaster and the finish also is wood or wood lath and plaster. A brick building will often have one front or side built of cast iron, or it might have the brick walls faced with stone for decorative purposes, or the entire wall might be built of stone.

Stone Building.—A Stone Building is a building with walls built of stone blocks, that is, the floor loads are carried on stone walls.

Iron or Metal Building.—An Iron or a Metal Building is a building with an iron frame work for the walls and covered with corrugated iron or some form of sheet metal.

Mill Constructed Building.—A Mill Constructed Building is a building built according to the practices of the New England Mills. The thing that distinguishes a Mill Constructed Building from other buildings is the use of extra large size timbers for supporting the floors, the use of extra thick planks for the floors, the fact that the construction is entirely open and with no concealed spaces, and the fact that stairways and elevators are built with brick surrounding walls.

Slow Burning Building.—A Slow Burning Building is the same thing as a Mill Constructed Building. The term is used because the large size timbers and thick floor plank used in Mill Constructed Buildings do not burn through, except after several hours duration of the fire, and it is this long endurance of the structural supports of the building which is the basis for calling these buildings Slow Burning.

Fireproof Building.—A Fireproof Building, a Fire Resistant Building, or a Fire Resistive Building is a building which does not use wood in its structural supports, such as, the walls, the columns, the girders or the beams. Steel, brick, clay tiles or mixtures of cement, stone and steel, that is, concrete, is used in place of wood. Most Fireproof Buildings have outside walls of brick, but in some cases the walls are stone blocks, or brick walls, faced with stone, or concrete walls.

A special class of Fireproof Buildings and perhaps the largest class are those which use an iron or steel framework for the entire building or for only the interior supports. The steel frame building is the typical skyscraper construction, but there are several modifications.

Bearing Wall Buildings.—In these buildings the outside walls not only support themselves, but in addition are used to carry part of the floor loads, that is, beams and girders will rest upon the outside walls.

Curtain Wall Buildings.—In these buildings the outside walls support only their own weight, and do not carry any of the floor loads or the interior steel or iron framework. The outside walls practically act as a covering or enclosure, and for this reason are called curtain walls. In these buildings also, the arrangement of the steel or iron framework is known as skeleton construction, from the fact that the building is built on the plan of a skeleton, which is a framework of bones or members supporting a body or structure.

Cage Construction Buildings.—In these buildings the steel framework carries all the loads of the structure, including the outside walls. The outside walls are not built up from the ground as is the case in the bearing walls and curtain wall buildings, but are built from floor to floor ou the outside girders of the steel framework or cage. This form of construction is the most modern steel construction and is used in the very high buildings, particularly the tower buildings.

Concrete Buildings.—A Concrete Building is a building whose walls and interior construction of floors and partitions are made of concrete.

Re-enforced Concrete Buildings.—A re-enforced concrete building is a building, whose walls and interior construction including the floors and partitions are built of concrete re-enforced with steel, usually in the shape of rods or bars.

What is a Fireproof Building? An exact definition of what makes a fireproof building, or a precise test of what is and what is not a fireproof building is difficult to set down, because it is largely a matter of individual opinion. One rule which will help in deciding whether a building can be considered fireproof or not is the following:

Are the bearing and supporting members or parts of a building non-combustible, such as brick, tile or clay, concrete, iron or steel?

This means that the walls, the columns, the girders, the beams, and the floor arches or filling between the beams are of these materials. These are the principal or essential requirements for fireproof construction. In some buildings entitled to be called fireproof, the iron or steel framework may be unprotected, or the stairways, elevators and other shafts may be enclosed, or the roof may be of ordinary wood construction, but these defects are not considered sufficient to deprive the building of a fireproof classification, but they indicate a less degree of fireproofness and make it necessary to qualify the use of the term.

CHAPTER XXXI.

CLASSIFICATION OF FLOOR OPENINGS.

FOR Fire Prevention purposes in so far as the construction of a building figures, the openings through the floors are the most important feature. In a majority of cases, if a fire has started and is under headway, the question of its extending throughout the entire building depends on the floor openings.

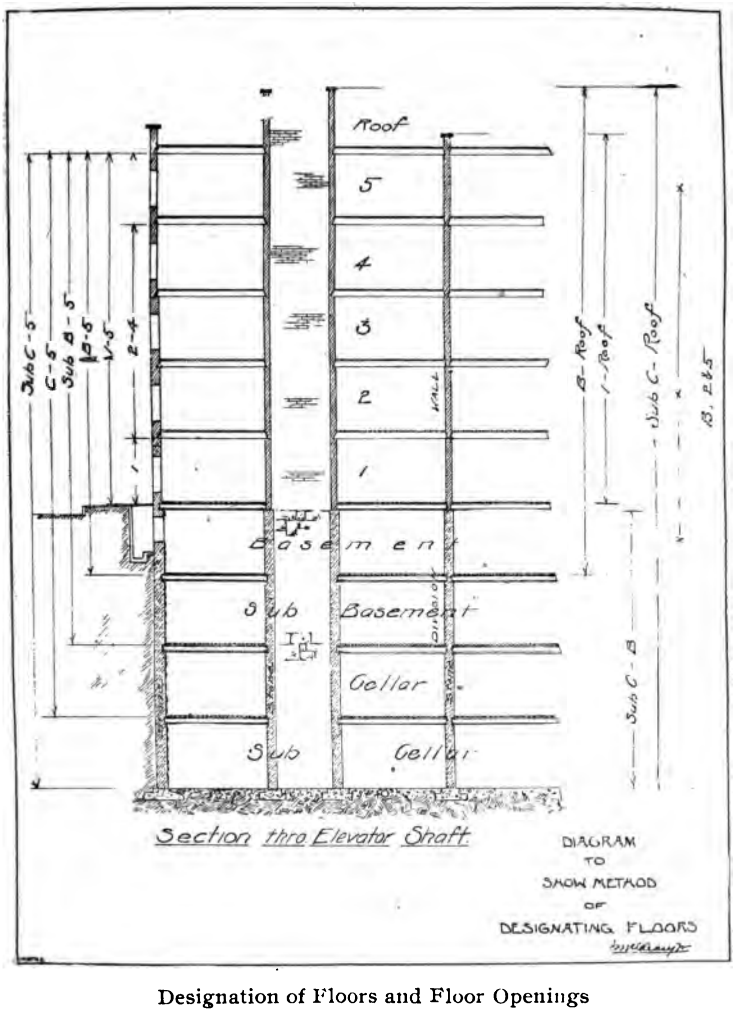
Definition.—A floor opening can be described or defined as a vertical opening in a building, that is, a hole or a break in the floor construction, sometimes existing on only one floor, or existing on several floors, or all the floors of a building. Floor openings are the vertical openings in a building, while doorways and windows may be considered the horizontal openings.

Shafts.—Floor openings may or may not be shafts. The shaft is usually considered to be a continuous enclosed opening, such as the entrance and passageway to a mine. The shaft is also sometimes considered to mean a hole or opening as well as the walls which surround and enclose the opening. As a rule, in Fire Prevention matters, the shaft means the enclosing walls; if a brick shaft is mentioned, for example, it means the enclosing walls of brick; if a frame or wood shaft is mentioned, it means the enclosing walls of wood, etc.

In connection with floor openings, the difference between the opening as such and the use that is made of it should be clearly understood. In respect to an elevator, for example, the car which carries the passengers or freight is the elevator proper, while the vertical opening is the elevator well or the elevator shaft. In the case of a stairs, the opening is the stairway, while the staircase or the stairs proper, is the construction used by the occupants.

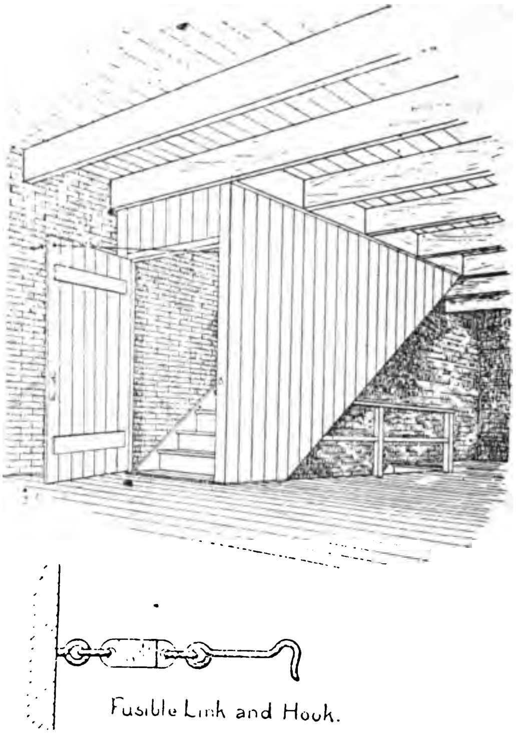
In observing floor openings and describing them for Fire Prevention purposes, it is well to make a distinction between the walls of the shaft, the openings in the walls, and the materials or devices which are used to shut or cut off these openings.

Fireproof Shafts.—What makes a fireproof shaft depends upon the standard or the specifications used by the organization having jurisdiction. It is the universal practice to specify incombustible materials, but there is not always agreement about various materials or their use.



Designation of Floors and Floor Openings

One shaft construction which is undoubtedly accepted as a standard fireproof or fire resistant shaft is the brick shaft, that is, the walls are of brick, the shaft extends from the basement to and above the roof with a bulkhead, and all openings in the walls of the shaft are closed with fireproof doors or windows. Shafts similarly built of hollow tile or terra cotta blocks are also very generally accepted as standard shafts as far as the use of these materials are concerned. The same thing is true of concrete shafts when well constructed. In the case of plaster blocks, cinder blocks, metal lath and plaster and sheet metal on iron frames there is not so much agreement, and whether such constructions are standard or not, must be ascertained from the officials having the decision in such matters.

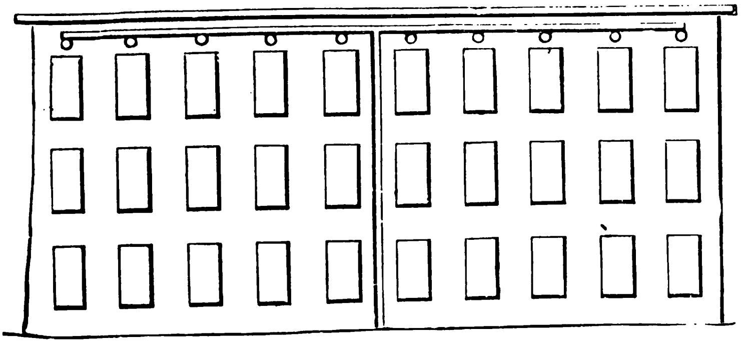

Fusible Link and Hook.

Boxed Stairway and Self-Closing Door

Non-Fireproof Shafts.—Non-fireproof shafts are those whose walls are built of combustible materials, such as boards on metal framework, metal sheets on wood framework, board partitions with glass windows, or wood, lath and plaster partitions.

An open shaft is one without any walls enclosing the shaft, or without any other enclosure, such as the partitions which enclose a hall. Some floor openings are enclosed by partitions or walls at some distance from the opening itself. The hallway of the stairs in an ordinary dwelling house or old style tenement is an example; also the stairway in many factory and mercantile buildings, which is enclosed by a board partition which allows hallroom on each floor. This form of stairway enclosure is sometimes called a frame enclosed stairway to distinguish it from the boxed stairway.

The boxed stairway is enclosed close to the line of the stairs and has no hall or landing within the stair enclosure. Each flight of stairs is in a separate box of its own, and there is no direct passage from one flight of stairs to another flight of stairs. In order to pass from one floor to another, a person must pass out on the floor or loft space in order to reach another flight of stairs.



Arrangement of Open Sprinklers, One Line Under Cornice

CHAPTER XXXII.

FAULTS OF MANAGEMENT.

FAULTS of management, or as abreviated, F. O. M., is the term in use in New York City and elsewhere, to describe the frequent and common causes of fire that should not exist in buildings which are kept clean, tidy, and in good order and repair. The presence of F. O. M. is a sign of careless or neglectful management, and indicates that the owners or persons in charge are not taking proper and necessary precautions to prevent fire.

The following list of F. O. M. is a partial one, and should be added to from time to time:

Heating, lighting, or power apparatus, in condition to cause fire.

Untidy condition of premises, such as rubbish, old lumber, broken plastering, etc.

Packing material not properly handled.

Ashes not properly handled.

Sweepings not properly handled.

Sawdust on floors.

Oiled soaked floors.

Oily waste not properly handled.

Neglect of fire appliances.

Fire doors, windows, skylights, floor openings, not properly closed.

Stove pipe holes uncovered.

Broken windows.

Holes in floor or ceiling.

Bottom of floor openings untidy or used as closet, or for storage purposes.

Closets used to store old clothes, oil-soaked rags, oil lamps or other objectionable articles.

Paper ceilings.

Clippings, cuttings and sweepings on floor, in wood boxes, or barrels.

Oil soaked things in quantity, cotton waste, oil soaked rags or any material for wiping, rubbing, polishing or for other uses which result in absorption of hazardous chemical, when not kept in standard self closing waste cans.

[illegible] less than three feet wide and not leading to windows, stairs, fire escapes; windows blocked with goods, etc., [illegible] preventing entrance of firemen.

CHAPTER XXXIII.

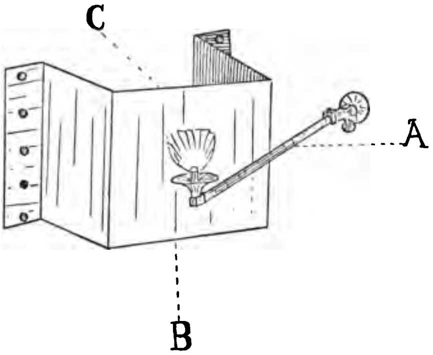
UNSAFE GAS JETS.

THE New York Building Code, Section 89, reads as follows: "All gas brackets shall be placed at least three feet below any ceiling or woodwork, unless the same is properly protected by a sheld, in which case the distance shall not be less than eighteen inches.

"No swinging or folding gas brackets shall be placed against any stud partition or woodwork.

"No gas bracket on any lath and plaster partition or woodwork shall be less than five inches in length, measured from the burner to the plaster surface or woodwork.

"Gas lights placed near window curtains or other combustible material shall be protected by a proper shield."

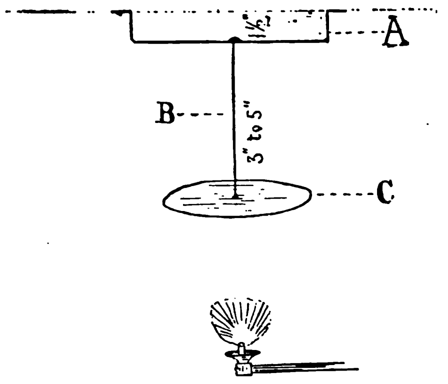


The ordinary two-joint swinging or folding gas brackets is best corrected by replacing it with a rigid or permanent iron pipe. If for any reason this cannot be done, the next best thing is to provide a metal shield, as shown by the illustration. A represents the swinging bracket, B the tin shield, and C the air space. This air space should be five inches in depth from the wall to the inside surface of the tin shield.

Gas jets (whether on swinging or rigid brackets) at windows, work tables, work benches, sewing machines, etc., or in any place where inflammable materials may come in contact with the flame, should preferably be replaced with incandescent electric lights, or the gas jet protected with a wire cage as illustrated. This protection is required in places with readily inflammable contents, such as paper warehouses, paper box factories, etc.

Wire cages should be strongly made, large enough to keep materials away from the flame, and tightly fastened to the bracket. Many wire cages have the mesh so large that objects can get through the space between the wires. They are also made so small that they constitute very slight protection, and sometimes so flimsy that the least blow breaks them; moreover, they are frequently attached so loosely that they are easily knocked off, and not replaced.

It seems ridiculous, but experience makes it necessary to caution against considering wire cages as protection for gas jets under wood shelves or combustible objects, or as protection against the vapors of volatile or explosive substances. For the latter, the proper protection is to do away with gas jets and use a double socket incandescent electric light, while for the former condition, the gas jet should be removed or metal shields provided.



This illustration shows a good method of protecting gas jets that are less than three feet below a wood or lath and plaster ceiling. A represents a sheet of tin formed as illustrated, with one and a half inch air space between the bow of tin and ceiling. B is a wire three to five inches long, fastened to A; C is a tin disk or pie plate suspended by the wire B above the gas jet.

CHAPTER XXXIV.

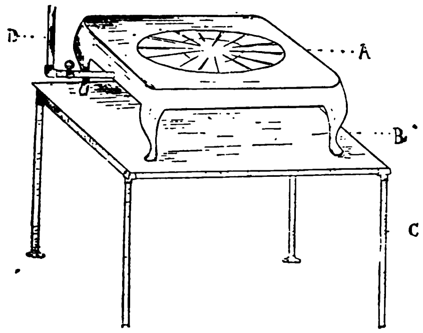
SOME UNSAFE GAS APPLIANCES AND HOW TO CORRECT THEM.

IN almost all business places and in many homes and dwellings, there are a number of stoves and other appliances using gas for fuel or light which are frequently in a condition to cause fire.

This unsafe condition is not only bad from a fire standpoint, but when the building is inspected for insurance purposes the unsafe conditions are noted and an increase in the rate of premium made. This raises the cost of insurance and causes trouble and delay in getting the policies written at the lowest rate.

Among the most common unsafe gas appliances are the ordinary gas stove, the gas muffler or furnace and the blow pipe.

The following directions for making these appliances safe are worth following on the score of improving the fire conditions, but they are also in accordance with the rules of the New York Board of Fire Underwriters and the New York Fire Insurance Exchange, and are therefore of use in following insurance recommendations:



The first illustration is a gas stove showing it as it appears when properly arranged:

A represents the stove.

B the sheet of metal under the stove.

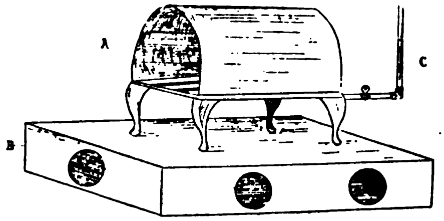
C the iron stand on which rests the sheet of metal and the stove.

D the fixed iron pipe connection to the stove.

The sheet of metal must be free and clear of all wood work and placed directly upon the iron stand. A common mistake is to place a wood base underneath the metal, but this is not safe and is not approved.

The iron stand is often constructed of gas piping jointed together with elbow joints. The more common method, however, is to procure an old sewing machine stand, remove the wood top, and place the sheet of metal on the iron stand.

In the heating of pitch, cement or any similar material that is likely to catch fire when it boils over into the flame, it is not considered safe to use a gas stove. It is much better, and insurance rules usually require the use of steam instead of fire heat, but if it is not possible to use steam, the stove can be improved by placing it inside of a metal pan. This pan should be large and deep enough to contain all the pitch or other material that is likely to boil over. This pan should also be raised above the table or bench by setting it upon an inverted pan or on metal supports at least three inches high.



The second illustration is a gas muffler or furnace used for heating soldering irons.

A represents the muffler.

B the raised metal stand with perforated sides.

C the fixed iron pipe connection.

The stand should be made of strong sheet metal somewhat of the size and shape of an inverted baking pan and at least three inches high.

The muffler or furnace should have an iron pipe connection, as the rubber tubing is not safe, and its use is never approved for this appliance.

In the case of gas blow pipes or brazers, the use of the appliances requires that it be flexible and movable, and for this reason, the rubber tubing is approved. All the objects being brazed or heated, however, should be placed in or suspended above a metal pan, the pan to be set on metal supports at least three inches high. When stationary blow pipes are used, such as the small pin flames used by jewelers and glass workers, they should be placed on metal with a quarter-inch sheet of asbestos board underneath.

CHAPTER XXXV.

FIRE HAZARDS OF A GAS ENGINE.

THE gas engine has several recognized fire hazards, for which rating organizations make a charge or addition to the insurance rate.

These hazards exist in connection with the exhaust chamber, the exhaust pipe, the rubber bag equalizer, and the oil-soaked floor around the engine.

In the newer and modern types of gas engines, some of these hazards have been eliminated. The use of an electric spark for ignition purposes in place of the hot tube removes much of the hazard attached to the rubber bag; the hazard of the rubber bag is entirely removed by using a cast iron equalizer chamber, in one type of engine, the equalizing being accomplished by the use of a leather diaphragm and an aluminum valve.

Even with the modern gas engine, the hazards of the exhaust and the oily floor remain, while with the older engines, the rubber bag and the hot tube are present in addition. In New York City, the New York Board of Fire Underwriters has adopted rules covering these hazards. These rules are also in use by the New York Fire Insurance Exchange for rating purposes.

A gas engine set upon a wood floor is required to have metal underneath. The metal must extend 24 inches beyond and all around the base of the engine. The purpose of the metal is to catch the oil drip, and where this is considerable, the metal has to be turned up at the edges, so as to form a pan to hold the oil.

The rubber bag used as an equalizer must not be placed over any lights or the hot tube of the engine. It is required to be set at least three feet in a lateral direction from the hot tube. The bag must be renewed as soon as it shows any sign of the rubber cracking or getting in condition to leak.

The exhaust chamber and the exhaust pipe become very hot. As a precaution the exhaust chamber is required to be supported at least four inches above the floor, on iron legs or stands, or in place of this method the chamber may be set on a course of brick laid on the floor.

The exhaust pipe as well as the exhaust chamber is required to be free and clear of all woodwork. Where the pipe passes through partitions there must be at least two inches of clearance, and the woodwork shielded. When the exhaust pipe passes through the floor construction, the portion of the pipe between the

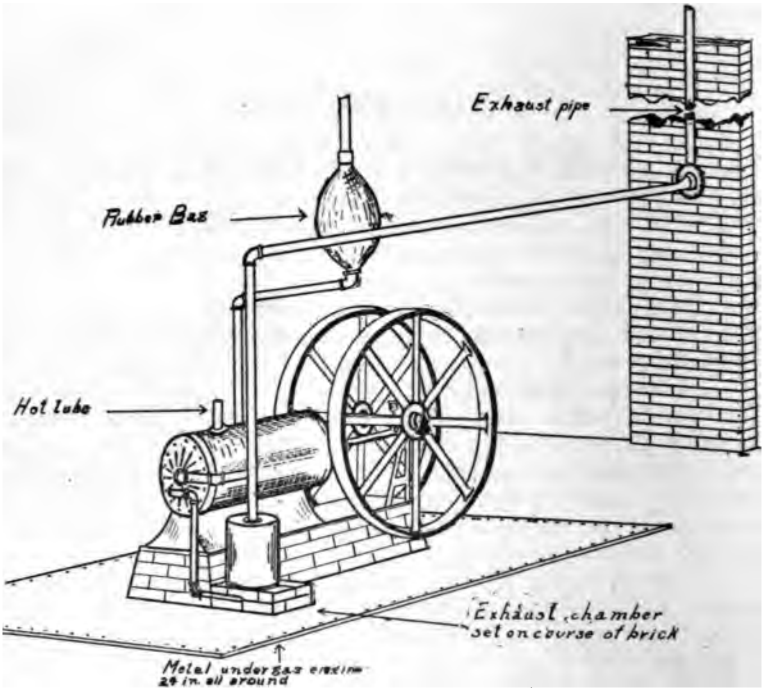

Exhaust pipe
Rubber Bag
Hot tube
Exhaust chamber set on course of brick
Metal under gas engine 24 in. all around

Diagram of Gas Engine Protection

ceiling and the floor is required to be covered with fireproof pipe covering and enclosed in a metal sleeve. When the exhaust pipe is let into a flue or chimney, it must be carried to the top of the chimney, and several feet in the air. The necessity for this arises from the fact that the flame of the exhaust is liable to set fire to the soot or vapors in the chimney, and also, because oil is frequently exhausted from the pipe.

CHAPTER XXXVI.

FIRE RESISTANT PACKING BINS.

ON the development of fire preventive measures tin-clad wood has been found to be an excellent fire resistant. Its most common use is in the construction of fire doors and fire shutters, and the protection of dry rooms and dry boxes, but it has also been adapted to packing bins. The necessity of making these fire resistant is apparent in view of the readily inflammable nature of the contents, usually excelsior or straw, such materials are not only offering the possibility of spontaneous combustion, but also favoring quick ignition by sparks, matches, lighted cigars, heated soot or small particles of fire.

The ordinary wood box is quite inadequate to withstand or contain a fire fed with such fuel, and it seems only a reasonable precaution to utilize a bin with better fire resistant capacities. This is accomplished by using a strong, well made box and lining the inside, including the cover, with tin put on with flat seams lock-jointed together. This method of joining tin shets is employed in making a tin roof, and its advantages in respect to keeping out rain apply as well to keeping out fire. To accomplish the latter it is necessary to protect all nails holding the tin covering, for the application of heat would result in loosening the nails and thereby releasing the tin covering. The best protection for nails is afforded by the lock-jointed seam, which covers the nails with several thicknesses of tin. This seam is formed by clipping the corners of the sheets of tin and turning up the edges, in which position the sheet is nailed. Then the edges of the adjoining sheets are locked together over the nails, after which the sheets are flattened and the seams hammered down. This lock-joint seam not only protects the nails and makes a continuous covering, but also prevents the oxygen of the air from reaching the wood. Oxygen is necessary for combustion, and by excluding it, the tin covering acts as a protection for the wood and thus retards its destruction when attacked by fire.

The use of this improved packing bin is calculated to reduce very much the chances of fire in loose packing material, and even if fire should start in or extend to the contents of the bin, there is a reasonable assurance that it will be confined to the bin.

Such a bin is a necessity wherever loose packing material, such as excelsior, hay, straw or cut paper, is present as part of the regular day's work, which applies to the usual packing or shipping room, but its use is advisable as a receptacle for any loose inflammable material likely to favor the quick spreading of fire.

To be of service, the bin should be strong, well made, and conform to proper specifications. It is better to have it made by workmen experienced in making fire resistant devices, though any good workman can make it by carefully observing the specifications.

The ordinary packing box is rarely put together well enough to answer the purpose, and as it seldom meets the specifications, its use is not advisable. As a good packing bin will last indefinitely, the first cost is the only expense, and it appears sound economy to procure a first-class article at the outset.

Specifications for the Construction of Fire Resistant Packing Bins.—Capacity—Maximum capacity of bin is limited to 64 cubic feet. The dimensions may be varied at convenience, provided the set capacity is observed. A typical bin is approximately 5 feet by 4 feet by 3 feet, which accommodates a large bale of excelsior.

Material.—Bin, including battens, to be made of white pine tongued and grooved boards not less than ⅞ inch thick, nor more than 6 inches wide.

Construction.—a. Bottom, top and front and rear of bin to be fastened to the battens with 10d. cut nails; ends to be fastened to battens with 2½ inch wrought nails driven through and clinched.

b. Top of bin to consist of two sections. The rear section is usually 12 inches to 18 inches wide and is permanently fastened as prescribed by specification a. The front section, the cover proper, is to be reinforced with battens and to be hinged in order to permit of readily covering and uncovering the bin.

c. The hinges to be used are 8-inch heavy strap hinges fastened with ¼ inch carriage bolts, the heads of bolts to be inside and the nuts outside.

For a cover of 3 feet wide 2 hinges are necessary, and 3 hinges for covers in excess of 3 feet.

d. The cover is to be provided with a 3-inch hasp and staple plate fastened with bolts.

e. The use of screws in place of bolts is not approved.

f. The cover should be set in a 1-inch rabbet or, overlap the edges ½ inch all around. The rabbeted cover is recommended because of its greater efficiency and durability.

For convenience in drawing material from the bin, the cover is generally made sloping instead of flat, as shown by illustration, the front of the bin being cut down to the waist height of a man, about 42 inches.

The placing of the cover in the front of the bin is not recommended, as it permits the loose material to fall out of the bin. Where conditions make it necessary to have a front cover, it should open not lower than 2 feet above the floor, and have attached outside a heavy hook and eye to fasten the cover to the bin when closed.

Tinning.—a. The inside of bin, including cover, is to be lined with tin put on with flat seams made with ½-inch lock joints and all nail heads covered by the seams.

b. The tin is to weigh 107 pounds to the box of 225 sheets 10 inches by 14 inches. The trade term for this tin is I. C.

c. Sheets are not to exceed 10 inches by 14 inches and are to be fastened on the short dimension with not less than 2 nails and on the long dimension with not less than 3 nails, with an additional nail in the corner. The nails to be used are ⅞-inch barbed wire nails.

d. All edges, including the cover, are to be protected with a band of galvanized iron, No. 28 gauge, which is to extend over and beyond the inside and outside of edges to a depth of not less than one inch, and on the inside is to be locked into the tin covering with a regular lock-jointed seam.

Fusible Link.—When the cover is to be kept permanently open, it is necessary to use a fusible link and to provide a check or guard to keep the cover forward of the perpendicular.

The fusible link, which is needed to insure an automatic closing of the cover in the event of fire, should be placed on the under side of the cover as shown by the illustration. A good arrangement is to fasten one end of the fusible link to the retaining cord and the other end to an S hook, which is attached to a staple set in the cover. When the bin is not in use the S hook is released and the cover closed; when the bin is in use, it is convenient to attach the S hook and thus keep the cover open.

The check or guard which may be simply a block of wood fastened to the rear section of the top of the bin or hoop or bow of strap iron, should be so placed that the point of contact is high enough to remove excessive strain from the hinges.

The retaining cord should be carried over the edge of the cover and fastened as conditions permit. It should be made of such length that the cover will be kept forward of the perpendicular, so that the melting of the fusible link will cause it to fall.

Location.—Packing bins should not be placed under or near a gas jet or close to stoves or other heating apparatus, electric switchboards, motors, dynamos, or other possible sources of sparks or flame.

CHAPTER XXXVII.

SAFETY RECEPTACLES FOR ASHES, RUBBISH, PAPER AND OILY WASTE.

A PILE of rubbish is a ready-made bonfire and affords an easy opportunity for malicious or mischievous persons to start a fire and escape unobserved. Hardly a day passes without the Fire Department being summoned for rubbish fires, and while many are extinguished with little damage, a number result in serious fires, frequently attended with severe injury to persons or with loss of life. Rubbish fires may be ascribed to carelessness or to the neglect of ordinary precautions, and the responsibility for them can be directly laid to those charged with the order and cleanliness of buildings, and, indirectly to the owners, proprietors or agents, who employ incompetent janitors or superintendents. The use of metal receptacles, kept covered, and the daily removal of rubbish at the close of the day should be made a part of the daily routine, and if made a regular practice, would tend to improve buildings in other respects than in the prevention of fire.

Care of Waste Paper.—Waste and scrap paper usually forms the largest part of rubbish heaps. The Street Cleaning Department in New York has tried to educate people to the advantage of keeping paper separate from other rubbish, and along this line of compulsory good housekeeping, the insurance organizations make an addition to the rate for rubbish or untidiness in a building.

Paper takes fire so easily that it is a common cause of fires due to lighted cigars, cigarettes, matches, sparks or spontaneous combustion. In dwelling houses and the usual business building, the use of good metal cans, similar to the ordinary ash can, but larger and provided with a cover, is effective.

In buildings where the accumulation of paper is too large to be handled in cans, there is sometimes used a large box or bin. Such a bin should be tin-lined and the cover held open with a fusible link arranged to drop the cover in case the contents take fire. The use of such a box is objectionable because it is not emptied frequently enough and the paper is permitted to accumulate and form a heap on the floor. In many office buildings where the cleaning of offices results in large accumulations of waste paper, the paper will be kept in the basement, sometimes in an open space, sometimes in a special room. Even where a room is used it is seldom properly prepared for this purpose, and the danger from accumulations of waste paper is one of the worst features in buildings that are generally supposed to be well-managed.

In department stores, insurance organizations practically insist on waste paper being kept in a fireproof vault. The vault is usually of brick or other incombustible material with tin-clad or good iron door. No light or heat is permitted in the vault.

In risks where accumulations of paper is an unavoidable part of the work, such as paper box factories, paper cutters, etc., it is hardly practicable to use cans or boxes to hold the clippings or waste. It is usually required, however, that they be not permitted to accumulate unnecessarily, and an effort is always made to have them gathered up daily, baled, and the bales removed every few days.

Ashes, also, are a common cause of fire, because while still hot or containing live coals they are placed in wood receptacles or mixed with combustible materials and left unobserved while slow combustion takes place. Fires which originate in this manner are especially dangerous from the liability to start during the night or at other times when the premises are deserted, and thus gain headway before discovery. They can be almost entirely prevented by the use of metal cans, kept covered while on the premises, and the removal of these cans at the close of the day, precautions which should be part of any good management.

In addition to rubbish and ashes, oily or greasy waste materials deserve close attention in view of the possibility of spontaneous combustion or ignition. This phenomenon, which is possible without the assistance of any external heat, may be the result of various processes, a common one being the chemical process whereby substances combine with the oxygen of the air.

One effect of this combination is the heating of the substances, and under favoring conditions this continues until flame results. Fibrous materials, porous materials and finely divided materials favor this process because of their capacity for absorbing oxygen. When these materials are brought in contact with oils or fats the tendency to spontaneous ignition is greatly increased. This is due to the oils or fats being exposed to a large amount of oxygen through for distribution over a large surface occasioned by the process of absorption. The combination of oils or fats with oxygen is attended with the usual increase of heat which, added to the heat already present in the substances through the previous absorption of oxygen, produces a condition most favorable for spontaneous ignition. In general, then, any oily or greasy material may be considered especially liable to cause fire, and, accordingly, should be subjected to more than ordinary precautions. A simple and effective precaution is the use of a metal receptacle, known as the Self-Closing Waste Can, which is intended to contain the waste material accumulated in the course of the day's work. This can is constructed of galvanized iron or steel, set on legs and provided with covers closing automatically. It is designed to contain within itself any fire that originates in the contents, while the cover is made self-closing to provide against oversight which would leave the can uncovered and so provide an unlimited supply of oxygen, favoring spontaneous ignition in the case of oily or greasy materials.

Self-closing waste cans are intended to be used only during working periods; at the end of these all waste materials should be immediately removed from the premises or destroyed.

Specifications for the Care of Ashes, Rubbish and Oily Waste.

Ashes.—Ashes should not be accumulated but removed from the premises as soon as collected.

They should never be kept in a building overnight.

They should not be piled on the floor but collected in metal cans; the use of wood boxes or barrels is strongly condemned.

They should never be mixed with rubbish, wood, garbage, paper, shavings, straw, excelsior, clippings, waste or other combustible materials.

They should not be placed close to stock of any kind, woodwork, oils or inflammable liquids.

They should not be placed near elevator, stairway, dumbwaiters, light or ventilating shafts or other openings through the floors.

Ash Cans.—Engineers' ash can: Boiler rooms, heating plants, power houses, furnaces and other places where large quantities of ashes are made should be provided with ash cans of extra strength. The can known in the trade as Engineer's Steel Ash Can, is suggested because of its durability. This can is made of not less than No. 18 metal, U. S. Standard gauge, with extra heavy hoops on top and double hoops on the bottom, and when reinforced with iron or steel staves is more durable.

Ash cans with wood staves are not approved.

Ordinary ash can: In buildings where coal stoves are in use and only a small quantity of ashes is made, Engineer's Steel Ash Cans are recommended, but not necessary. In their place, galvanized iron or steel ash cans made of not less than No. 24 metal U. S. Standard gauge, reinforced with steel staves and having hoops at the bottom, making a raised bottom, are approved. Staves and covers are required for these cans.

Ash cans with wood staves are not approved.

Rubbish.—Rubbish should not be accumulated but removed from the premises as soon as collected.

It should never be kept in a building overnight

It should not be placed in uncovered receptacles.

It should not be mixed with ashes, oily or greasy materials.

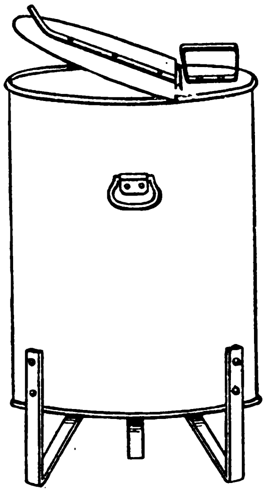
It should not be permitted in or near the bottom of elevator, stairway, dumbwaiter, light or ventilating shafts or other openings through floors.

It should not be permitted in vaults, yards, areas, closets, attics, roofs or under sidewalk gratings.

It should not be permitted near boilers, furnaces, stoves, dry rooms, drying machines, steam pipes, hot air pipes or other heating apparatus.

It should not be permitted near electric switch boards, dynamos, motors, or machinery in general.

Rubbish Cans.—Rubbish, sweepings, clippings, waste paper, sawdust, shavings, garbage and similar articles of refuse should be collected in metal receptacles provided with covers. The usual ash or garbage can made of galvanized iron or steel, will answer the purpose, but special cans, known in the trade as Stable or Street Cleaning Department cans, will be found especially adaptable. Covers are required for rubbish cans.



The use of paper or wood boxes, barrels or bins is strongly condemned. If the quantity accumulated in the course of the day is too large to be handled in cans, the emptying of the cans twice or oftener during the day is better than building a large receptacle.

Oily or Greasy Waste Materials.—Oily or greasy waste materials, such as cotton waste or rags for cleaning machinery, excelsior or similar material used in rubbing or staining woods, and all other material which in various processes absorb oils or fats, should be kept in metal cans, which are approved for this purpose only when made of iron or steel, set on legs raising them several inches above the floor, and provided with covers closing automatically. The lid of the can must have a hoop or bow attached in such maner as to prevent the cover swinging back of the perpendicular. Cans of this kind are on the market and may be obtained from the regular dealers in such articles.

Waste cans are required to be emptied at the close of each day's work or oftener if necessary, and the contents removed from the premises or destroyed.

The contents of waste cans must not be placed in receptacles intended for ashes, sweepings, waste paper, garbage or other refuse, or otherwise mixed with these articles.

The use of a number of small waste cans in place of fewer large cans is strongly recommended.

Waste cans are a necessity wherever oily or greasy materials exist, but particularly in establishments such as the following:

Printing and lithographing press rooms,
Machine shops,
Automobile garages or repair shops,
Engine rooms, including Gas Engines,
Motor rooms, including Motors,
Paint and Varnish Works,
Filling, rubbing, staining and varnishing rooms,
Ink grinding establishments.

CHAPTER XXXVIII.

USING AND STORING BENZINE IN SMALL QUANTITIES.

THE fire danger of benzine, gasolene, naphtha, and other volatile liquids hardly needs any statement. There is need, however, of calling attention to some simple means of lessening the danger—such as the use of safety cans. There are on general sale a number of cans designed for holding benzine, and these should be used in the home as well as in business places. A few of these cans are illustrated herewith. Their value consists in being self-closing, so that after use the opening is automatically closed and the explosive vapor does not escape and the liquid is protected from sparks or lights.

Insurance rules invariably require that benzine be used from a safety can, and that the self-closing arrangement be kept in effective working condition. The neglect of this causes an increase in the insurance rate.

As a general fire precaution, as well as conforming to insurance rules, it is well to keep in a building no more than is in actual use or contained in the safety cans. If the operations, however, require a supply, the supply should be cut down as much as possible, such as limiting the quantity to what is needed for one day's use or a maximum quantity of five gallons.

The supply, furthermore, should be kept outside of the building. This is usually done by storing the supply can in a yard, alley or other open space. By necessity sometimes the window-sill or fire escape has to be used for this purpose.

To make sure that the supply can will be properly handled, and also to comply with insurance rules, the can should preferably be of the safety pattern, and permanently attached by a chain or steel band to prevent its being taken into the building for the filling of small cans.

In places like cleaning establishments, garages, large printers, etc., the handling of benzine is done on a large scale.

CHAPTER XXXIX.

PRECAUTIONS IN HANDLING CELLULOID.

THE manufacture of celluloid is confined to a few factories, but the number of places where it is worked or on sale is much larger than would be supposed.

Celluloid, as a material, is tough, somewhat elastic substance, resembling ivory, bone and shell, for which it is used as a substitute. It is made by treating pure cotton or tissue paper with nitric acid, and mixing the product, called pyroxylin, with camphor, alcohol, coloring matter, and sometimes oil, compounds which are classed as volatile, flammable and explosive. It takes fire readily, burns fiercely with a rustling oil-like flame, and the fire is frequently accompanied by explosion. As salable articles, celluloid is found in combs, piano keys, toilet articles, smokers' articles, toys, fancy goods, novelties, etc.

In the working of celluloid, a number of causes of fire exist. In the cutting, a circular saw is used, and sparks are caused by the saw striking some hard foreign substance in the celluloid. This substance is believed to get into the celluloid by way of the scrap celluloid which is made over into new celluloid. The danger from sparks is very great in connection with celluloid, and for this reason, the celluloid maker has been urged to carefully sort out celluloid scrap and run it over a magnet in order to draw out any metallic substances which may be present.

The grinding and sand-papering of celluloid also results in sparks which is especially dangerous because of the presence of dust resulting from these processes. As a precaution, an effective blower system is necessary, and this should be constructed of metal and used only for collecting celluloid dust. The receptacle also should be used only for this purpose, and should also have a cyclone separator so that the dust is not discharged directly into the receptacle. This should be of incombustible material, such as sheet metal, cement or brick, and in its location, be detached from the building. Sometimes the dust can be discharged under a spray of water or into a tank or sunken reservoir.

Scrap celluloid is probably the most common cause of celluloid fires, and accordingly should receive the most particular care. It should never be permitted to be mixed with rubbish, nor to acummulate in a building, but should be removed every day, and while in a building, kept in self-closing metal cans.

When stored in quantities, special provision should be made, such as the use of a separate building or a separate compartment in a regular storehouse building, and in addition to this precaution, the scrap celluloid needs careful watching to prevent a fire.

The heating of celluloid, in order to shape or bend it, also involves a danger of fire. The steam tables, the steam-heated hydraulic press and the steam piping should be kept clear of woodwork and arranged so that no stock, except that being heated, comes in contact with the hot surfaces. The steam table is sometimes covered with paper in order to prevent overheating, and this paper should be incombustible, such as asbestos paper. The steam tables are also likely to become dangerously hot; a temperature of from 160° F. to 250° F. is sufficient to make the celluloid plastic enough for working; a temperature of above 250° F. is dangerous.

The dipping of celluloid articles constitutes a danger because of the presence of inflammable gases. The dip contains amyl acetate (banana oil) and is inflammable and volatile. The amount of the dip should be kept as low as possible, and the process should be carried on in a separate room or building of incombustible construction, detached if possible or at least cut off from other rooms. The room should be well ventilated and have no heat or light, but where lighting is necessary, it should be done by incandescent lamps with all switches and fuses located outside of the room or in some safe place. The same precautions apply where celluloid is cemented.

The storing of celluloid whether in the form of sheets or in manufactured articles involves the danger made by large quantities in a building. This is not only the liability of a destructive fire, but also the strong probability of a tremendous explosion. A common sense precaution, therefore, is to reduce to a minimum the amount exposed to one fire. To this end several rules can be followed, such as limiting the amount of celluloid in work to one day's supply; storing the finished goods in a place separate from the workshop; keeping the sheet celluloid in closed closets or cupboards, which should preferably be of incombustible and non-conducting material and separated as much possible, and limiting the quantity in one fire section of the building to 250 pounds.

CHAPTER XL.

FIRE ESCAPES AND EXITS.

EXITS can be defined as a means of leaving a building, and include the regular every-day exits, such as stairs, elevators and street doors, as well as emergency means of escape, such as outside fire escapes and other special forms of exit.

Fire Escapes can be defined as emergency means of leaving a building in case of fire and this means particularly outside fire escapes, rope escapes, patent escapes and other things intended only for use in case of fire.

Doors and Windows.—If doors and windows lead to a safe place, they are as a matter of common sense the best kind of fire escapes. They usually serve only first floor premises, but frequently can be used for floors which are just above the roofs of adjoining buildings, so that all is needed is to step from a window or a door and reach the other building.

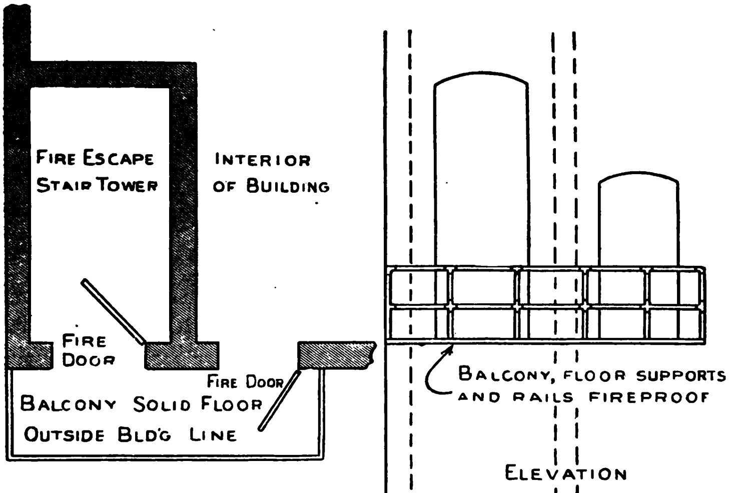
Division or Fire Wall Escapes.—These consist simply of doorways in a wall which completely divides a building in two, or is a wall between two separate buildings. This makes it possible for the people in either building to pass through the doorway in the dividing wall and pass down the stairs in the building which is not on fire. The use of these division walls as a fire escape is considered safe only when the wall exists throughout the building from the basement to the roof, and all the doorways and other openings in the wall are protected by automatic fire doors, which will close and confine the fire on either side of the dividing wall.

Ropes.—A good strong rope is the simplest form of fire escape, and for low buildings is found very handy and useful. To come down a rope for any distance is dangerous even for men and boys, while women and girls can hardly be expected to do it successfully. Putting knots in the rope at regular intervals is a help, and of course, the rope should be securely fastened and kept so that it will not tangle or kink.

Patent Rope Escapes.—These are improvements over the plain rope, and being cheap and easily installed they are found worth while where occupants will not use something better. They consist of a belt which fastens under the arms, or a handle to be gripped by the hands, and the descent of the escaping person is made slow and gradual by having the rope or cable under some form of a brake.

Flexible Ladder Escapes.—These are made like the ladders used on board ship and are arranged to fold up under the window until needed, when they can be thrown out and persons descend by them.

Fixed Ladder.—These consist of a wooden or metal ladder fastened to the side of a building and reached by stepping from a window sill.



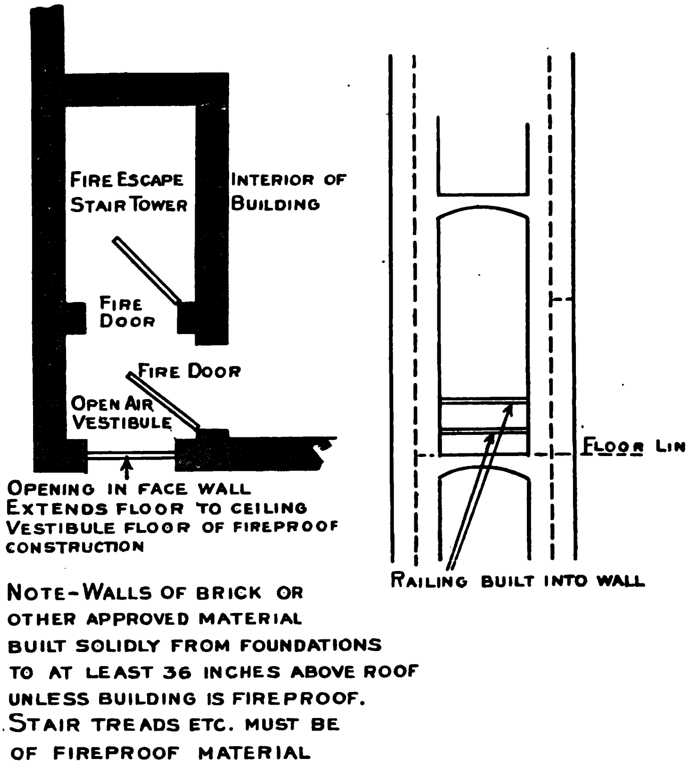
NOTE - WALLS OF BRICK OR OTHER APPROVED MATERIAL BUILT SOLIDLY FROM FOUNDATION TO AT LEAST 36 INCHES ABOVE ROOF UNLESS BUILDING IS FIREPROOF. STAIR TREADS ETC. MUST BE OF FIREPROOF MATERIAL

Fire Tower with Outside Balcony Entrance

Design by N. Y. Board of Fire Underwriters.

Balcony Escapes.—The balcony escape consists of a platform with a railing built in around all windows extending from window to window across a dividing wall between two separate buildings or two separate sections of the same building. This is one of the best forms of escape because endangered persons can step out of a window or doorway upon the balcony and then pass along to the next building.

Balcony and Ladder Escapes.—These consist of a balcony as just described, but it is usually constructed to serve only one building, so that means must be provided for people to pass from one balcony to another balcony above or below. One way is by means of a straight ladder which extends through an opening in the floor of the various balconies. This is the early form of balcony escapes and is no longer approved by the authorities.

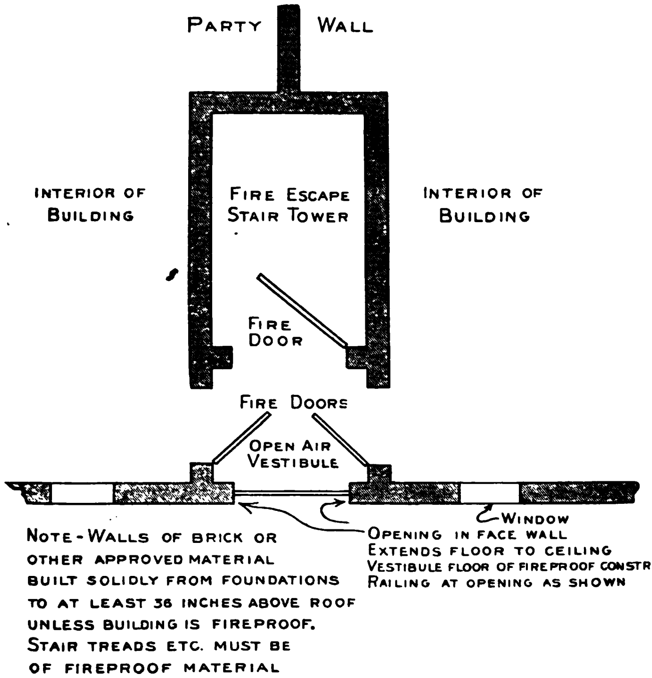

Fire Escape Stair Tower
Interior of Building
Fire Door
Fire Door
Open Air Vestibule
Opening in face wall Extends floor to ceiling Vestibule floor of fireproof construction
Note-Walls of brick or other approved material built solidly from foundations to at least 36 inches above roof unless building is fireproof. Stair treads etc. must be of fireproof material
Floor Line
Railing built into wall

Fire Tower with Entrance Through Inside Door and Vestibule

Design by N. Y. Board of Fire Underwriters

Balcony and Stair Ladder.—Instead of a straight ladder which runs straight up and down through the balconies, the ladder is placed at an angle or slanting and a hand rail is provided as an assistance in going up or down. In some cases the ladder consists only of two small bars or rungs as steps for the feet, while in better types, the ladder has steps or treads like an ordinary stairs.

Balcony and Stairs.—In this type of fire escape, the ladders described in the two preceding types are done away with and instead of them, regular stairs with broad treads are placed at an easy angle and good hand rails are provided. The stairs have landings and are just as comfortable and easy to use as a good stairway inside of a house.


Party Wall
Interior of Building
Fire Escape Stair Tower
Interior of Building
Fire Door
Fire Doors
Open Air Vestibule
Window
Note-Walls of brick or other approved material built solidly from foundations to at least 36 inches above roof unless building is fireproof. Stair treads etc. must be of fireproof material
Opening in face wall extends floor to ceiling
Vestibule floor of fireproof construction
Railing at opening as shown

Fire Tower Serving Two Buildings

Design by N. Y. Board of Fire Underwriters

Roof or Goose Neck Ladder. Outside fire-escapes of the balcony or ladder type, usually have a ladder from the top floor balcony to the roof. The ladder is built to curve over the cornice or edge of the roof, and for this reason is usually spoken of as a goose neck ladder.

Drop Ladder. Outside fire-escapes of the balcony type also have a drop ladder to enable persons to descend from the last balcony to the sidewalk or street. The drop ladder frequently consists simply of a plain iron ladder which will be hung up on the second floor balcony, and at time of fire must be lifted from its place and adjusted on the first floor balcony for use.

These ladders are very heavy and can be handled only by strong persons; they are frequently found out of place or missing, so that all good outside fire-escapes have them attached in a permanent way and also to be somewhat automatic in their operation. They will be made with a balance, so that persons stepping upon them will cause them to bend down to the sidewalk and take a position by which persons can use them. Another design is to construct the drop ladder in channels or tracks and hung up by a hook. When the hook is released and persons step upon the drop ladder, the ladder slides down to the sidewalk.

Stair Escapes.—This type of fire escape is very much like the preceding balcony and stair escape, except that there is no balcony as part of it. It consists of regular stairs placed on the outside of a building and reached by passing through a doorway. It is almost identical with an ordinary stairs inside a building.

Tower Escape.—This is sometimes called the Philadelphia fire escape or the fire tower. It consists of a regular stairs enclosed in a tower or shaft of brick or fireproof materials. The tower is absolutely shut off from the rest of the building, that is, it has no openings connected with the floors of the buiding. To enter the tower persons must first step out on a balcony to reach the tower or entrance into the tower. Its construction makes it practically impossible for fire or smoke to get into the tower and therefore makes it probably the best of all fire escapes.

Chute Escape.—This consists of a chute or tube constructed with a spiral opening, so that persons can simply jump into the tube and descend to the bottom of it. It is usually constructed of steel and works well at times, but it is not considered reliable or a substitute for the better types of fire escapes.

CHAPTER XLI.

THE FIRE DRILL.

HOW to get people out of a building on fire is the all important question. Where life is endangered, all other considerations must be waived. On the score of humanity, provisions for the safety of inmates is important; on the grounds of self-interests, the same provision is worth many times what it costs.

In case of factories and work shops, the operations carried on and the nature of the building induces a condition of danger. The employer of labor is morally and legally bound to take steps for the safety of his employes. In doing this, he furthers his own interests, because, in addition to the peace of mind it brings in the fulfillment of his duty to those he has introduced into his building, he gives his workers an added sense of security which contributes to their efficiency and also improves the general management of his establishment.

The fire drill, when introduced into a factory or workshop, represents system and order where formerly was disorder and confusion. It provides a traffic regulation whereby thousands of employes can leave a building in a few minutes in an orderly manner that is conducive to safety. It causes an examination of exits and stairways to test their number and efficiency, and it provides beforehand for a contingency that cannot otherwise be properly handled.

The importance of the fire drill as an auxiliary to the Fire Department operations is usually overlooked. In a case of a factory fire, the firemen think first of the employes, and in the scramble to make rescues, discipline and system frequently go to the winds, and what is primarily the business of hook and ladder men is seized upon by engine men, fire patrol men, policemen, etc. This commendable zeal to save life sometimes results in neglect of the fire, while in some cases, the life saving requires the entire attention of the Fire Department and the fire has to be left to gain headway. This is a very common occurence and is worthy of the consideration of property owners and underwriters who are interested in the causes of fire loss. The property owner who is sincerely desirous of reducing the chances of loss and damage by fire should consider the fire drill a necessity in any building containing a number of persons. Similarly the underwriters, who consider physical and moral hazards of a risk must also take into account the presence or absence of a fire drill in the buildings.

The fire drill is very much like what in the city streets is known as traffic regulation, that is, instead of letting everyone leave a building by any exit he or she chooses, certain exits are assigned to the occupants of certain floors. This arranges it so that the flow of people from one floor does not meet the flow of people from another floor and collisions are avoided.

Under ordinary conditions one exit may be enough, but for an emergency such as a panic or a fire, one exit would be entirely inadequate and result in congestion liable to cause injuries to many persons. The fire drill, therefore, is the problem of arranging for a quick dismissal and the providing of ample exits. It is desirable to provide, if possible, a separate stairway for each floor, but, of course, this cannot be done in high buildings. In some cases a stairway is wide enough to accommodate two streams of people; by putting up a stout hand rail, the stairway can be divided into two, and the people from one floor or section of the building can use one side, and the people from another floor or section use the other side.

After the question of exits is settled, the next step is drilling the occupants. In case the people in a building comprise foreign nationalities, and different ages and characters, the drilling has to be done slowly and carefully. The preliminary step is to post notices and distribute hand bills or cards, stating that a fire drill is to be introduced in order to help the employes to get out of the building rapidly and without confusion. Later a second notice is distributed giving some details about how the drill is to be carried on. Copies of these notices are given to all occupants, so that they may take them home, and those who do not understand them fully can have them explained by other persons or by children, who are familiar with the fire drill as carried out in the public schools. A final notice is distributed giving the rules and explicit directions which are to be followed by everyone.

In organizing a drill some person on each floor, such as, the foreman, acts as a captain, and all the persons on that floor are instructed to follow his orders. Some men should be detailed to handle the fire appliances, such as, pails and extinguishers; others should be appointed as guards to stand on stairways and crowded points to keep the lines moving and help persons who may be in need of it. In case there are dressing rooms, some person should be designated as searcher to examine them and see that no one is left behind.

A system of alarm gongs should be installed which will permit an alarm being sounded from the foreman's desk on any floor. The ringing of a floor signal should cause a fire alarm to be sent to Fire Headquarters, so that the fire apparatus can be started for the building at the very first signal. Within the building, the floor signal should be sounded on all the other floors in the building, the number of strokes of the gong informing everybody in the building on what floor the fire is.

When a Fire Drill alarm is sounded, the persons detailed as guards, fire fighters and searchers should go quietly to their places, get the fire appliances ready and open the doors. The employes or occupants should be instructed to rise quietly, remove seats or benches from the aisles and passageways and get ready to march toward the exits. In some cases, it may be possible to have all this done by a signal from the captain of the floor, but where this is not possible, the drill should be arranged to work without special signals. In marching and in descending stairs, it is sometimes found an advantage to have girls and women march in pairs and to link arms as a support to each other and not to press on the couple ahead.

The net result of a fire drill is that system and order exist, where formerly everything was left to chance; it means instituting a prearranged method of leaving a building, which is repeated and repeated until the occupants become thoroughly accustomed to it, and whenever a fire alarm is sounded, they do it as a matter of course. The great lesson taught by fires in which many persons are injured, is that the panic, the excitement and the loss of control is largely responsible for the disaster, and it is to avoid these things that the Fire Drill is used.

CHAPTER XLII.

FIRE PREVENTION FOR THEATRES, WHAT IS DONE IN NEW YORK.

DO the million of theatre-goers, who frequent New York's ninety-three theatres, know what is done for their safety against fire?

Fire is at its worst in a theatre. The Iroquois Theatre disaster in Chicago, in 1893, cost 580 lives. In the Ring Theatre fire in Vienna, in 1881, 450 persons were lost; the fire in Conway's Theatre, Brooklyn, 1876, cost 300 lives, while there is on record many other smaller catastrophies.

The Fire Department is doing everything in its power to prevent fire and, with the co-operation of other City Departments, maintains a system of inspection that has put the theatres in better condition than other buildings which house numbers of people.

In order to understand how this system works, you should first know what a theatre has to do in the way of fire prevention and fire protection.

Like any other building, a theatre has to conform with the Building Laws in matters of plan and construction, but in addition, it has to meet special requirements for the safety of life. New theatres, for example, have to be of fireproof construction, and all theatres have to have aisles, passageways, fire escapes and exits, sufficient to accommodate the size of their audience. Such matters are covered by the Bureau of Buildings, which also supervises the fire-proofing of the scenery as required by law.

The electric installation, a very important feature in the theatre, is passed on by the Electrical Bureau of the Department of Water Supply, Gas & Electricity, and the Fire Commissioner has taken the position that the Fire Department will not approve any theatre which has not received a certificate from the other city departments having jurisdiction. A theatre cannot open wtihout a license from the Police Commissioner, who is required by law to obtain a certificate from the Fire Commissioner before issuing the license. The effect of this is to make the Fire Department the controlling department.

The average theatre-goer has no conception of the precautions against fire that are now taken in a theatre. People go to the theatre to enjoy themselves, not to be thinking of a possible danger, so the most that they see is a uniformed fireman on his tour of inspection just before the performance; they may notice a hose and extinguishers in the auditorium, glance at the "Exit" diagrams on their programs, and observe that over the Exit are red lights, which are always kept burning during a performance.

This is all that appears in front of the curtain. But how many, as they sit looking towards the stage, realize that they are facing a solid brick wall. It is covered with painting and decorations but it is there for one purpose, to stop fire on the stage from getting out into the Auditorium. This wall, the Proscenium wall, as it is called, is built from the cellar up through the roof and into the air for several feet. There have to be openings in it, doorways in the basement for the musicians to pass through, doorways on the first floor to provide for communication between the stage and auditorium, and the proscenium itself, the large opening which reveals the stage and the players to the audience.

In order to make this wall a solid fire stop, all these openings have special protection against fire. The doorways have duplicate fire-doors, one on each side. These fire-doors are made of three thicknesses of wood, and covered with tin the same as a roof. They will stand off the hottest fire for several hours and they are also arranged to be closed by the fire itself. This is done by hanging them on an inclined track and holding them back by a chain with a fusible link in it. This fusible link is a piece of metal that melts at 165 degrees Fahrenheit and breaks the chain, leaving the door free to close itself.

The proscenium arch has a fire curtain, which early comers see being raised in advance of the regular curtain. The fire curtain has heretofore been made of asbestos but iron curtains are now coming into use. In case of fire on a stage, this curtain is dropped instantly, a duty which is placed on the stage carpenter, who has a fixed position on the stage during a performance and who is a reliable man for prompt action. To drop the curtain instantly it is only necessary to cast loose a single rope, or cut it with a knife, which is kept near by for this purpose.

The dropping of the curtain cuts off smoke and flame from the audience and keeps the fire entirely on the stage. Another precaution to keep the fire away from the audience is the skylight on the roof of the stage. Few people understand why a stage should have so many skylights but the firemen know how absolutely necessary they are. The opening of a skylight in a burning building provides a quick outlet for the heat and smoke; it draws the fire up and out of the roof, thereby freeing the lower floors of smoke and heat. This is the result especially desired in a theatre fire, to draw away from the audience the smoke, gases and flames and, for this reason, ample skylight space is required in a stage roof.

Stage skylights, to be effective, should be arranged to be opened automatically, that is, by the fire itself, as well as by someone on the stage. For this reason, they are so constructed that the burning of a single rope will release them, or the same result will follow if this rope is cast off, or cut away. This is the same scheme that is used with the asbestos curtain.

The curtain and the skylights are for the purpose of shutting off the fire from the audience. Then there is a special fire alarm for calling the Fire Department. This alarm box is right on the stage so, on the discovery of a fire, in ten seconds, Headquarters would be notified, in another ten seconds, the firemen would get the call and, in ten more, the companies would be on their way. Every theatre has a special fire alarm number, so that the firemen know immediately what building to proceed to. Special fire extinguishers are also on the stage. There are pails and barrels of water, chemical extinguishers, hooks and axes; there is also fire hose connected to a stand-pipe. The stand-pipe is a water supply line connected to a tank on the roof; it has also a Siamese connection on the outside of the building to which the fire engines connect and pump water. In case of fire, the firemen on duty, or the stage hands, can stretch the hose and get a stream of water working in two minutes, because the roof tank keeps the stand-pipe always filled. When the firemen arrive, they can run right into the theatre and use the theatre hose, instead of having to delay by stretching in their own hose.

All these appliances are for use by hand but more important is the automatic extinguisher. Over the stage itself, the rigging loft, the fly galleries, the gridiron, and other portions of the stage that people in the audience know little about, there is a system of pipes filled with water. Pipes exactly similar to these can be seen on the ceilings of department stores. In these pipes, at every few feet, are set sprinklers, a small mechanical device for automatically turning on water in case of fire. The sprinkler is simply a special kind of water faucet; it is kept closed by a piece of fusible metal, just the same as is used to hold back the fire door. Once this metal is melted, the water bursts out like a huge watering can; the water descends like a miniature shower bath, and covers an area nearly ten feet in diameter. When you consider the sprinkler goes off at 165 degrees Fahrenheit, it can be opened by holding a lighted match under it, you can see what an active fire extinguisher is distributed all over the stage.

The sprinklers, as well as the stand-pipe, need plenty of water, so on the roof are tanks of water. These tanks are only temporary supplies, intended to last for only a few minutes, and, as they also have to be kept filled all the time, a fire pump is necessary.

A fire pump is a regular fire engine; it can pump from 250 to 1,000 gallons per minute, and, like a fire engine, it has to be kept ready for action at any minute. If the water gets low in the tanks, the pump at once starts automatically to refill them; in case of fire, the pump not only starts to keep the tanks filled but it also pumps directly into the sprinklers and stand-pipe.

Briefly, this is what a theatre has to provide in the way of fire protection. To every theatre, the Fire Department sends a uniformed fireman at every performance. This fireman is called the Theatre Detail and his duties are laid down in the Fire Department's Book of Rules. The Detail reports at the theatre a half hour before the performance. The first thing he does is to notify Headquarters of his arrival. In the special fire alarm box on the stage, is a Morse Key, and with this, the Detail sends in his "taps" and, if the alarm is in proper condition, Headquarters sends the answer tap-tap, tap-tap-tap-2-3, O. K.

He then makes a round of the entire building, opens and shuts all the exits, tries all the fire doors, the curtain rope, the skylight rope, sees that the extinguishers are ready for use and, in general, makes sure that the entire fire protection system is in proper condition. During the performance, he makes three tours of the building, to prevent blocking of the aisles and exits by standees and to see that other fire regulations are being observed. At other times, he has a position on the stage, ready to act in case of emergency.

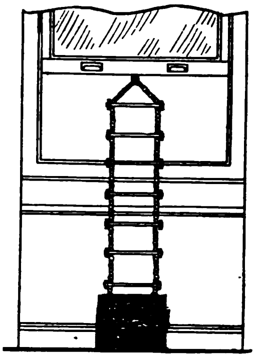
A fire protection system, to be worth anything, needs constant inspection and last year the Fire Department Theatre Inspectors made 15,000 inspections of theatres. There are six Theatre Inspectors, uniformed officers of the Department, of the rank of Assistant Foreman. Each inspector has a section of the city and inspects all the theatres on that section. Each month the inspectors change about so that every month a theatre is inspected by a different officer, and receives a thorough test and overhauling.

The inspector, for instance, operates the fire pump; makes a personal examination of the tanks to see if they are filled; the sprinklers are also examined to see if they are in good condition and not obstructed in a way to render them ineffective. The stand-pipe hose, the valves, and the Siamese connection receive a similar examination.

The fire curtain is raised and lowered, the releasing lines tested and their arrangement examined in respect to being clear and having proper signs. The releasing device for the skylights is tested in the same way, the skylights opened and closed, and their condition as regards blocking by snow or ice looked into.

All the fire doors are opened and closed and the fusible links examined. The water pails are inspected and the chemical extinguishers emptied and recharged twice a year, the exits tested and the diagrams verified, and the certificates from the other City Departments inspected.

After this thorough inspection, the inspector re-visits the theatre, to examine special features and he also instructs the Detail in his duties.



CHAPTER XLIII.

NEW YORK FIRE DEPARTMENT RULES FOR THEATRE INSPECTORS.

1. Exit Doors and Passageways.
2. Asbestos Curtain.
3. Skylights.
4. Fire Doors.
5. Diagrams on Programs.
6. Exit Signs and Lights.

Fire Appliances.

1. Fire Alarm Box.
2. Automatic Sprinkler Equipment.
3. Standpipe (fire line).
4. Fire Extinguishers.
5. Fire Buckets.
6. Fire Hooks.
7. Fire Axes.

General Conditions.

Electricity,
Gas,
Scenery and Stage Props,
Combustibles and Explosives,
Heating Arrangement.

The following instructions are issued to Theatre Inspectors, with directions to transmit same orally to the men detailed at theatres or large assemblages during performances, in so far as said instructions apply, and they will be held strictly accountable for any neglect in connection therewith.

The instructions will be followed as closely as conditions permit and it will be understood that the existing Rules and Regulations (Sections 255 to 268—Year 1905) remain in force.

Instructions For Theatre Details.

Asbestos Curtain.—See that asbestos curtain is in proper working order before the performance. The curtain must be operated before the performance begins—lowered and raised. Lines for operating curtain must be kept clear of obstructions at all times, and in such position as to be accessible without any delay. Proper signs and releasing device must be provided.

Skylights.—Skylights must be kept in order for immediate use at all times, and must be operated at least once each week—omit on stormy days. Skylights will be kept free of snow and ice, and after snow storms operated every day until snow has gone.

The lines operating skylights must be placed in an accessible position as near stage door as possible, and kept clear of obstructions at all times, proper signs and releasing devices must be provided.

Fire Alarm.—Box must be near stage entrance with a key in charge of watchman. Tests will be made as required by existing Fire Department Rules, and any defects will be made subject of proper report.

Fire Buckets.—Must be kept filled with clean water, on proper shelves, or hooks, and free from obstructions at all times.

Fire Doors.—Details must thoroughly familiarize themselves with the operating devices attached to fire doors, whether automatic or otherwise, see that same are kept in good working order, and free from obstructions at all times.

Combustibles and Explosives.—In making daily examination of the building any accumulations of rubbish or unnecessary scenery found will be made subject of report to Theatre Inspector, as well as the use of any explosive or combustible material either in the performance or for other purpose in the building.

Sprinkler System.—A thorough examination of the sprinkler system will be made at least once each week, before performance. The condition of water supply in tank will be noted by a personal examination of the tank, irrespective of devices, such as electric or other tell tales. The heads will be thoroughly examined and the area to be covered will be gone over. Obstructions and defects which would interfere with proper operation of system must be removed without delay.

Standpipe System.—A personal examination of the standpipe equipment, including condition of water supply in tank, the pump, and hose outlets will be made each week and proper report made certifying to the general condition of same, that hose reels or racks are in such condition as to permit quick stretch of lines, and that outside connections are in good order and unobstructed.

Fire Extinguishers.—Should be examined each day—discharged once every six months, and properly tagged showing date of recharging. They must be kept on proper shelves or hooks, in accessible positions and must not be obstructed at any time.

Exit Doors and Passageways.—See that all exit doors anc passageways are not obstructed, in proper order and ready fo immediate use and outside stairways kept free from snow and ice.

Exit Signs and Lights.—See that all exit signs are of proper size, and lights indicating location of exits, both inside and outside of buiidlng, are kept lighted at all times during performance.

Programs.—See that proper diagrams of exits are provided on program of each performance, and that the terminals of such exits are clearly explained at bottom of each floor plan.

Scenery and Stage Props.—Ascertain if same has been treated with fire proofing solutions, and notify Theatre Inspector without delay when any defective or dangerous material is put on stage for use.

Electric Light Wiring.—Certificates are issued by Electrical Bureau, Department Water Supply, Gas & Electricity, covering all electric light wiring and lighting effects, machines, etc., and details are instructed to see that such certificates cover all such material and machinery in use.

Gas.—If gas is used within building, see that no swinging brackets are used, and that such brackets as are used are properly protected by globes or glass coverings.

Fire Hooks.—Must be kept in accessible location and free from obstructions.

Fire Axes.—Must be kept in good order, in accessible location and free from obstructions.

Heating Arrangement.—Make careful examination of heating equipment, and note anything that may appear dangerous or liable to cause fire, and report same to Theatre Inspector without delay.

Note.—These regulations are not intended to supersede any existing regulations and must be considered as additions thereto only.

Inspectors will make personal inspection of all theatres in their districts monthly and deliver report on form No. 23 to this office not lated than the 20th day of each month.

In such houses as are provided with men specially detailed the Inspector will direct such special detail to make report as above, which must be delivered not later than 5th day of each month, with such recommendations and endorsement as may be considered necessary by the Inspector.

CHAPTER XLIV.

FIRE PREVENTION FOR SCHOOLS.

The Lessons of the Collinwood Fire.

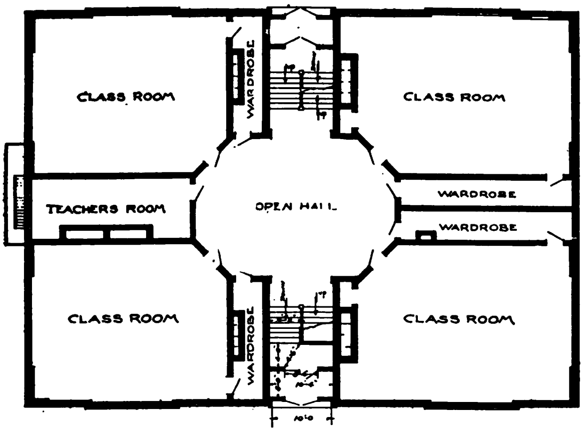
THE school building at North Collinwood, near Cleveland, Ohio, in which more than 160 school children were burned to death, was a brick structure, with wood floor beams, three stories and basement in height and of moderate area. In plan the building was a large rotunda, around which the class rooms were grouped. In halls opening on the rotunda were two stairways opposite each other and leading to the front and rear entrances on the first floor. A fire escape on one side of the building completed the means of exit.

One stairway, that in front of the building, extended to the basement, and up this stairway smoke and flames appeared about 9.30 A. M., March 4th. The cause of the fire was probably rubbish in closets near or under the basement stairway catching fire. It is, of course, possible that steam pipes started fire back of the plaster on the basement ceiling, but this idea is somewhat discounted because such fires usually announce their presence by smoke some time before the flames break out. The origin of the fire, however, is less important than the succeeding causes, which made it a catastrophe.

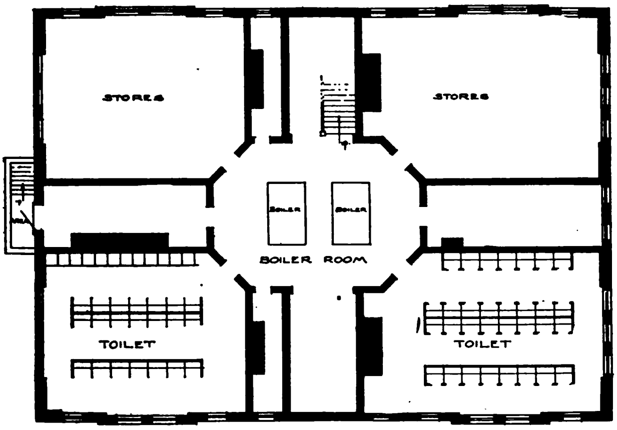
The fire drill in the school provided for the classes using the two stairways and the two doorways, front and rear. When the bells were rung the drill proceeded as arranged. The lines of children accustomed to use the front doorway passed out this way until the smoke and flames coming up the basement stairs stopped the use of this exit. Some of the pupils were turned back and got out the windows and down the fire escapes.

The great loss of life was among the classes accustomed to use the rear doorways. The children became jammed in the vestibule, and the struggling heap of teachers and children was packed so tightly that hardly any could be pulled out by main force before the flames reached them, which happened within a few minutes.

Once the fire got a hold on the first floor, the flames were directed from the front stairway clear across the rotunda and right upon the mass of struggling children. This action of the fire is perfectly understood by fire engineers. The natural vertical rise of the fire up the front stairway and the rotunda was



·PLAN·OF·FIRST·FLOOR
(SECOND FLOOR THE SAME)
SCALE 1/8"=1'-0"



·PLAN·OF·BASEMENT·
SCALE 1/8"=1'-0"

THE SCHOOL BUILDING AT NORTH COLLINWOOD, O.

From sketches and measurements made by C. B. J. Snyder, Supt. of School Buildings and Architect to the Board of Education, New York.

CHAPTER XLV.

CONSTRUCTION OF SCHOOLS FOR FIRE SAFETY.

ANY proposals looking to safety against fire in school-building construction must expect objections on the ground of cost. Few towns or cities have the wealth to erect the more costly "fire-proof" structures, nor are they called on by increasing demand for educational facilities to put up many new buildings, thereby offering the chance of providing better structures. For various reasons, therefore, it is to be expected that frame or ordinary brick buildings will continue to be the most numerous type of school buildings, and it is for such buildings that fire recommendations are most needed. At the outset, it must be emphasized that the plan of the building and the construction of the vertical openings are more important than the type of structure or the choice of materials. These two factors affect the safety of the lives of the occupants very decidedly, and this is more important than the destruction of the building.

The Plan.

In the planning of a school building as distinct from its architectural design or type of construction, fire safety suggests some modifications. That buildings be low is a fundamental recommendation; school buildings should never be more than six stories high and preferably should be limited to three or four stories. Small buildings, that is, a reduced area for each building or section of a building, is also a fundamental principle. Five thousand square feet as the maximum for any building is the judgment of scientific firemen like the late Chiefs Bonner and Kruger, of New York. This limitation is meant for unbroken areas such as would be open to one fire. The use of fire walls with protected openings, or partitions equal to fire walls, reduces areas to meet sound fire protection requirements and provides virtually separate and distinct buildings.

The location of exits should aim to eliminate or reduce horizontal distances from assembly or recitation rooms to stairways, and from stairways to the outer spaces of safety. Stairways should be placed close to the outside walls, and if possible towards the corners of the building; they should be planned so that the lines of pupils will diverge rather than converge; the terminals of the stairs at the street levels should be virtually outside the building proper, that is, close to streets or other open spaces in order to obviate passing through halls, corridors or vestibules before reaching the safety of the open air.

Basements or cellars as well-known fire breeders would not be found in buildings designed for the highest degree of fire safety. A more moderate and entirely practicable and necessary requirement is the complete isolation of the basement from the rest of the building. The first floor should be solid and without openings of any kind. Necessary stairways to the basement should be placed outside the building walls; such shafts or openings as cannot be dispensed with should be rigidly cut off, that is, enclosed with incombustible materials and the doors or windows protected with automatic doors or traps having fusible link catches.

The first floor construction should be of "fireproof" construction to some extent, no matter what the rest of the building is. For frame or wood buildings it should be a plank floor, or if wood beams are used these should be filled in with some form of concrete or fire blocks. Ceiling the beams with metal or other covering is good only as a makeshift, as it makes a hollow space in which fire may start or spread without discovery. For brick buildings, some form of incombustible construction should be used; the additional cost should be a concession to secure greater safety, and if necessary obtained by economizing in other directions. No single requirement, save perhaps protected stairways, equals isolating the basement in a fireproof manner. For "fireproof" buildings a word of warning is necessary; don't have unprotected unenclosed vertical shafts, such as stairways, elevators, pipe channels, chutes, or shafts for light or ventilation. This is a radical defect and reduces the value of "fireproof" construction almost seventy-five per cent. and makes the building little better than one of ordinary construction.

Construction and Materials.

It may seem useless to suggest fire protection measures for wood or frame buildings, but burnable as these buildings are they can still be made sufficiently fire-resistant to safeguard the lives of the occupants. This can be accomplished by fire-proofing the stairway exits. Make them enclosed and stopped off shafts, preferably of incombustible materials, such as brick, tile, concrete, metal, lath and plaster and wire glass. Such a precaution is just as sensible and expedient as making chimneys of brick. Even if incombustible materials cannot be used, there is no excuse for unenclosed stairways intended as exits in cases of fire. Metal-clad wood, plank partitions of two or three-inch stuff or even the ordinary seven-eighths-inch board enclosure, is better than no protection at all, as the lightest type will hold back fire for several minutes. If these lighter forms of stairway protection are provided with self-closing doors having fusible link catches, they will make a protected exit and allow the occupants to leave the building in good order.

In frame buildings, or all buildings for that matter, good brick chimneys are a fire protection asset; so is plank or mill construction, which means the avoidance of hollow spaces in the walls and ceilings. Partitions, too, planned as fire stops, increase the fire resistance of frame buildings and their construction should meet the specifications previously described for stairway enclosures. All that applies to frame-building construction holds equally true for ordinary brick buildings. Excepting the exterior walls, frame and brick buildings are practically identical in construction. As far as protection to life and property against fire is concerned, the brick building offers little more than the frame building; if its interior construction is faulty, fire will spread in a brick building practically as fast as in a frame building.

For most school buildings a floor construction of wood beams is probably a condition, not a theory. The practical necessities of this condition must be met and the thing to do is to secure what improvement is possible, that is, increase the fire resistance of this form of floor construction. Something is gained by filling in between the beams with concrete or fire blocks, or ceiling the floors with metal lath and plaster in preferance to wood lath and plaster or boards. Such a protection to wood beams provides a good check to fire burning directly through the floors. This improvement should be accompanied by another very necessary precaution, namely, avoiding hollow spaces at the walls, such as is made by furring or studded off construction, and of course, the feature first mentioned, enclosing all openings through the building as previously described.

The foregoing suggestions for increased fire safety in wood and brick buildings is a concession to actual conditions, since incombustible construction, however desirable, is simply not obtainable in many villages, towns and cities. Even where the money is available, it will take years to replace the present buildings. The active and widespread agitation for fireproof construction makes it unnecessary to saying anything here to advance it. What is needed, indeed, is a note of warning in regard to such structures; don't have unenclosed stairways and other vertical shafts. Don't, because of the use of incombustible materials, neglect the prevention of fire or proper measure to discover and extinguish fire promptly. Remember that fireproof construction does not remove the necessity for other measures; it is simply one step towards greater safety; it is not a complete solution of the fire problem.

CHAPTER XLVI.

FIRE INSPECTION OF SCHOOLS.

egular Inspections With Reports to Committee or Officials.

MOST fires are preventable, first, because their causes are known, and secondly, because these causes are simple in themselves and easily corrected. What is needed regular and systematic inspection to call attention to such atters, a feature which is one of the basic rules of the Factory utual Insurance System, founded by Edward Atkinson, and questionably the most effective insurance and preventive sys- n in force to-day.

A fire inspection should preferably be made at least four nes a year by a competent fire engineer, but where this cannot done a self-inspection at least should be made. For school ildings, the self-inspection could be done by the principal or nitor; but better results will follow if it is done by some per- n who is not daily engaged in the building. In New York ty, the inspections are now made by the officers charged with e repair and maintenance of the buildings. A practical builder, nstruction foreman or mechanic, a fire department officer or insurance man, who really knows something about fire pre- ntion and protection are good men to act as inspectors.

The inspector should use a report blank, fill this out on the ot while making the inspection and have the report counter- gned by the principal or person in charge of the school. The port should then go to the school committee or the official ho has undertaken to watch after the safety of the school, and ho will make an effort to have the necessary improvements d safeguards provided.

The accompanying form of an inspection blank is intended mply as a guide in preparing inspection reports to suit the eds of particular school buildings. The items cover most the preventable causes of fire that exist in schools generally, d the proper remedies are self-apparent or are stated in the rm. Some things have purposely been omitted, for example, e electrical features, as these require the attention of an elec- ical engineer. The report is intended to be suggestive and to imulate interest in the inspection idea. Once a building is in- ected with such a report as a guide, many special features are sure to present themselves, and for these specific information will have to be obtained.

Fire Inspection Report.

of the
.... School, ...
No. .... Date ....
Inspector .... Previous report................

Heating.

Coal stoves—Number and where located?...................
Woodwork and lath and plaster shielded with metal and air space?...................
Metal underneath and in front?.................
Pipes in contact with wood or lath and plaster? ....
Gas Stoves—Number and where located?...................
Rubber tubes or iron pipe connections?............
Woodwork underneath and on sides shielded with metal?...................
Boiler or Furnace—Number and where located?....................
Open or enclosed in room?....................
partitions of wood, lath and plaster, brick, terra-cotta or concrete?....................
Doors of wood, iron or metal-clad wood?........
............Self - closing with fusible link?...................
Ceilings boarded, open wood beams, lath and plaster?...................Shielded with metal and air space?...................
Storage of combustible materials or wood closets near by?...................
Metal cans for ashes?........................
Date of boiler inspection?......By whom?........
Flues and chimneys cleaner?............Date?..
.................Loose brickwork remortared?...................
Steam pipes with one inch clearance of woodwork?......................Metal collars and sleeves for pipes passing thru floors?......
......Metal screens for pipes and radiators in clothes closets and storerooms?..............

Lighting.

Gas—Shut off outside of building?........Location?..........
Swinging or folding brackets?..........Number and where located?.......................Removed or made rigid?......................
Gas lights within 6 inches of wood or lath and plaster?................Number and where located?...............Removed?................
Gas lights less than 24 inches beneath wood or lath and plaster?...................Number and where located? ....Removed?................
Gas lights without wire cages, globes or lanterns?........ Number and where located?................In storerooms or closets?................
Gas meter location?................Near boiler-room?

Storage.

In cellar or attic?.....................Kind of materials stored?...................Discontinued or enclosed in fireproof room?...................
Closets under or close to stairways?....................Removed?...................
Oils, paints or combustible material stored in building?....................Removed outside of building or enclosed in fireproof room, away from stairs and accessible for firemen?...................
Have storerooms fireproof doors and wire glass in windows and transoms?...................
Is waste paper and rubbish stored in building?............... Removed daily?..............Metal cans with covers provided?...................
Storerooms, repair and supply-rooms tidy and in good order?...................
Halls or stairs obstructed?............Where?............ Removed?...................
Do exit doors swing outward?...................Held with bolts or locks?...................
Exit doors tested?...............How often?...............
Fire-escapes ready for use?............Tested?............
Are ladders balanced or dropped by hand?................

General Condition.

Building in good order?..................................
Following repairs are needed..................................
Signature of Inspector......................
Signature of Principal......................

CHAPTER XLVII.

THE FIRE DRILL IN SCHOOLS.

A Problem of Traffic Regulation—Alarm System and Proper Exits Necessary Features—Not a Substitute for Other Fire Protective Measures.

THE extensive advertising given to the Fire Drill by the daily newspapers is to be regretted, because it has produced a wrong impression. By laying special emphasis on the Fire Drill it has caused overconfidence in this single measure of safety and caused a neglect of other absolutely necessary steps. It is also to be noted that the problem of getting hundreds or thousands of children out of a school building under the conditions of a fire in progress is an engineering proposition, and for this reason it is not fair to ask principals or teachers to undertake a responsibility which is distinctly unpedagogical.

Fire in school building presents all the attendant dangers of fire in other buildings, plus the special features made by the presence of numbers of children. All the measures taken for safety constitute a chain, of which the Fire Drill is only one. No matter how perfect or successful the Drill itself may be, its operation in an emergency may be destroyed through some other link in the Fire Protective chain breaking.

The Fire Drill is necessary because of the probable occurrence of fire. Prevent fire in the first place and the Drill will not be needed. It is put is as a precaution; it is not intended as an exercise or a challenge to fire, and it should be treated as an emergency measure, depended on only as a last resort.

As a matter of fact the Fire Drill is not aimed at the fire, but at the panic usually accompanying a fire, unless measures of control are forced. The dismissal of an assembly of people under ordinary conditions can be done without trouble, because enough people will wait and not overtax the capacity of the exits. Under excitement due to fire or other accident, a rush occurs which no amount of exit facilities can handle. Prevent this panic is the thing to do, and in school buildings, that is the purpose and function of the Fire Drill. It is to secure an orderly exit of the pupils under conditions of excitement. This means that the working or non-working of a drill is never seriously tested unless there is really a fire in the building and the presence of smoke or flame.

In the organization of a Fire Drill, there are three main features: Alarm system, Exit Facilities and Formation of Lines. The details of forming the children in lines and leading out the classes is a matter that school teachers, from their daily routine, should be entirely qualified to attend to efficiently. In fact their experience with children gives them a knowledge of how to deal with them which the Fire Engineer does not obtain. The custom of forming the lines in double file or two by two, the holding of hands or linking arms, the marching to music or the singing of songs, all such expedients are valuable in facilitating the marching and in diverting the minds of the children from the fire. In some details of the marching, the special knowledge and experience of the Fire Engineer becomes of value in an advisory capacity.

(1) Should teachers precede or follow their classes?

(2) Should the lines be formed with the large or small children in the lead?

(3) In mixed classes, should boys or girls lead in the dismissals?

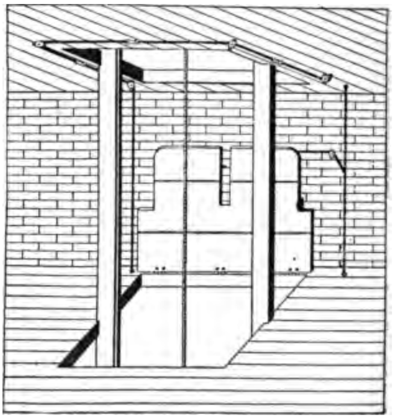
Similar questions have arisen in connection with Fire Drills in factories and business buildings, not to mention the actions of people in dwelling buildings, hotels, theaters and steamboats on fire. From the general experience in such cases, the following answers are in order:

1. The teacher should follow, in order to be sure that no child has been left behind through absence from the room, or through fainting. It may seem advisable to have the teacher lead, especially with younger children, but if the teacher gets too far from the end of the line, he or she might not be able to get back to take care of the stragglers. In factory buildings, searchers are appointed as part of the Fire Drill, to look for employees who are absent from their accustomed places at the time of the fire.

2. The older and stronger children should lead, in order to prevent overcrowding the younger and weaker. Here again it might seem advisable to give the weaker pupils the first chance to escape, but it will be found practically impossible to keep the stronger ones from overcrowding, if they follow.

3. The boys should lead and the girls follow for the same reasons, which apply to children of different ages. Boys and men always trample girls and women in a rush and if girl pupils cannot be led down separate exits, they should follow after the boys. Otherwise they are almost sure to be frightened at the boys coming down behind them.

The successful working of a Fire Drill is dependent to a large extent on the discovery of the fire and the sounding of warning signals. The essential features of a good interior alarm system to be used in starting the Drill are alarm boxes at accessible distances, the direct transmission of the alarms throughout the entire building, and a notification of the floor on which is the fire.



CHAPTER XLVIII.

FIRE EXITS IN SCHOOLS.

IT cannot be emphasized too strongly that the character and capacity of the exits is the most important feature of the Fire Drill. It avails little to have the pupils trained to march rapidly and in good order, if they are to be led down stairways that are already attacked by flames or hot smoke, or if these stairways lead to insufficient or defective exit doors at the ground level. The Collinwood School fire demonstrated this principle, that is, the Fire Drill was carried out, but the stairways proved to be veritable fire flues.

Whoever has charge of the Fire Drill, therefore, must look to the exits and give them the closest study. In this particular, if in nothing else, it is well to get the best engineering advice obtainable. If it is a matter of self-inspection, a study of the following proposed Exit Law, adapted by the writer from the Building Codes of Cleveland and New York, will be found helpful in determining if the exits of a school building are adequate and conform to good practice.

Proposed Exit Law.

An Ordinance to provide safe and sufficient exits for school buildings in the of .

Be it ordained by the as follows:

Section No. 1.—The following provisions shall constitute and be known as the School Exit Law of the of .

Section No. 2.—Definition of School Building.

School buildings are hereby defined as school, college or other buildings containing class drawing, lecture or other rooms for the purpose of education or instruction.

Section No. 3.—Definition of exits.

An exit is hereby defined to be a doorway (a) in the exterior walls of a building, and (b) opening on the level of a street, or on an alley, court or yard connecting directly with a street.

Section No. 4.—Number of Exits.

All scholl buildings shall be provided with (a) at least two exits, and (b) additional exits to permit all persons who may be in the building at any time to leave the building within four minutes at the rate of one hundred and twenty (120) persons per minute per exit.

Section No. 5.—Character of Exit Passages.

All exits shall be reached by stairways or halls with enclosures as hereafter specified.

Section No. 6.—Enclosures for stairways or halls used to reach exits shall be constructed of self-supporting walls or partitions of the following types:

A—Brick or other incombustible materials.

B—Metal stud and lath partitions plastered on both sides.

C—Wire glass in frames of incombustible materials or metal covered wood.

D—Metal-covered double or triple batten wood.

E—Dressed and matched plank not less than two (2) inches thick.

Section No. 7.—Buildings of Fireproof or First Class construction.

In buildings of fireproof or first class construction, only types A, B or C of enclosure partitions shall be used.

In buildings of fireproof or first class construction, all stairs shall be constructed of incombustible materials.

Treads and landings of stone, slate or marble shall be each supported directly underneath for their entire length and width by an iron plate made solid or with openings not larger than four (4) square inches, of adequate strength and securely fastened to the strings.

Treads and landings of iron shall be cast iron, with all upper surfaces properly corrugated, ribbed or otherwise provided with safety treads.

Section No. 8.—Wire Glass.

All glass used in doors or partitions of enclosures shall be (a) wire glass, and (b) not larger in size of pane or sheet than 20 inches by 60 inches.

Section No. 9.—Stairs.

No stairs shall be less than three (3) feet six (6) inches wide in the clear between hand rails or between hand rail and enclosed side of stairway.

No main stairs to which two side stairs connect shall be less than the combined width of the two (2) side stairs.

All stairs shall be continuous from the ground floor to and through the roof with door and bulkhead. Roof doors shall not be locked in any way except by a bolt or hooks, which can be drawn without the use of a key.

Stairways shall be located remote from one another and at opposite sides or corners of the building.

All stairs connecting the ground floor with the basement or cellar shall be located outside the exterior building walls.

Section No. 10.—Stair Landings.

No stairs shall have more than sixteen (16) risers in a run without an intermediate landing.

If a stair landing is in the direction of the run of the stairs its depth shall not be less than the sum of two (2) of its risers and two (2) of its treads.

If a stair landing is at the turn of a stairs it shall (a) be without steps, and (b) its depth shall never be less than the width of the stairway measured over all.

If a stair landing is for two (2) side stairs connecting with one (1) main stairs, it shall be (a) without steps and (b) in depth not less than three-quarters the width of the main stairs over all.

Section No. 11.—Hand rails.

All stairways shall have hand rails on both sides of the stairs, but hand rails are not required on level landings or platforms.

Section No. 12.—Doors.

All doors to stairways and halls used for exits shall be (a) self-closing doors with fusible link releasing hardware and (b) constructed of incombustible materials or metal covered wood.

No door in a stairway or hall used for exits shall open directly on a flight of stairs, but shall open on a landing. All exit doors shall swing outward and have hardware to hold them open in emergencies.

CHAPTER XLIX.

FIRE EXTINGUISHERS AND FIRE ALARMS IN SCHOOLS.

IN case of fire in a school, the first thought should be to get the pupils and teachers out of the building. This necessitates a Fire Drill, or as it is more correctly termed, a Panic Drill. It is aimed at other emergencies as well as fire and to prevent crowding or rushing by accustoming the pupils to march out according to a prearranged plan.

Preceding the Panic Drill, and in fact beng the first step, is an Interior Fire Alarm System. This is to notify all the occupants of the building that there is a fire or other unusual happening, and to give sufficient time and warning for a safe and prompt dismissal. It calls for alarm boxes or signal stations within a convenient distance of every part of the building, certainly not more than 200 feet, though any fixed distance may not meet the particular needs of certain schools. Two hundred feet is simply given as a guide, since it is the distance stated in the National Fire Protection Association's rules for Fire Alarms.

The alarm boxes should be arranged to sound prearranged signals on every floor of the building, and also announce on which floor is the fire. If a fire is on the top floor, for instance, there is less cause for alarm among those on the lower floors. This definite knowledge of the position of the fire helps the exit of the pupils. These alarms, also, should operate directly and immediately and not be dependent on action by some intermediate person, such as being first transmitted to an office or other central point and then retransmitted throughout the building. The principal or janitor as a re-transmiting agent cannot be depended on, as they are liable to be absent at the critical moment and the entire fire alarm and Panic Drill system be disorganized.

As part of the interior alarm system, the Fire Department alarm should be sent, assuming that the school is under Fire Department protection. The Fire Department alarm should preferably be by direct telegraph communication to Fire Department headquarters, or by the regular Fire Department alarm system in use. Each school should have a special alarm number so that the firemen will immediately know the exact location of the fire, and proceed direct to the school. If key boxes are used, the principal, the janitor and other responsible officials should have keys, so that no delay may occur on this score.

To guard against a delayed alarm through the regular Fire Department alarm being out of order, a supplementary Fire Department alarm should be provided. This should be operated by an independent system, separate and distinct from the regular alarm system, in order to provide two separate and distinct calls for the firemen, in case one or the other should fail. The telephone is an auxiliary Fire Department alarm, but if this is used, some steps should be taken to assure prompt connection and have the fire alarm message sent without interference or delay.

"First send the alarm, then fight the fire," is the one safe rule for fire emergencies and it applies especially to schools. There can be no mistake then or invaluable time lost. If the fire is insignificant, or there are men, women or youths able to handle simple fire extinguishing appliances, so much the better. It should be made a strict rule that no effort be made to fight a fire until the alarm has been sounded. Many serious fires have been due to neglect of this rule and it is far better to call the firemen to false alarms or already extinguished fires then have one fire get away from amateur fire fighters.

For fighting fire in a school, there are only to be recommended simple hand appliances, such as water pails, wet brooms or mops, National Fire Protection Association chemical extinguishers, which are 2½ gallon soda water machines. Firemen's hooks and axes may also be installed as the hooks may be useful in pulling down burning clothing or overhead draperies. If the fire however, requires cutting up a floor or opening up a wall or partition, it is a job for regular firemen, and should not be attempted by amateurs, except as a last resort. A few lessons in throwing water from a pail, using a wet broom and handling a chemical extinguisher are strongly recommended, if the services can be obtained of a fireman, who is skillful in these apparently simple things. For a nation that spends half a billion dollars yearly in fire waste and fire protection, it might be worth while to teach the young idea something about Fire Prevention and Fire Protection.

The preceding Fire Protection should be installed in every school building as the cost is trifling. Further measures, perhaps available only for wealthy communities, are the automatic fire detector or alarm and the automatic fire extinguisher. The appropriation for these are in the nature of a sound investment, because of the great security they afford and for school buildings without first class Fire Department protection, are almost indispensible, where the destruction of school buildings would be a serious financial and educational loss.

The automatic fire alarm consists of a fire sensitive wire or appliance called a thermostat, which is placed all over a building and when touched by heat rings gongs and indicates the location of the fire. It is a precaution especially valuable for hidden fires, slowly gathering headway without being noticed, and also for fires that start on Sundays, nights and holidays, when the building is not used, making up in some measure for the lack of a watchman patrolling the premises under supervision.

The automatic fire extinguishing system, or sprinklers as they are called, is the one great fire device that has safeguarded our big mills, warehouses and Department Stores. The automatic sprinkler is a special kind of water faucet, to use a familiar parallel, which is turned on the fire by the heat of the fire itself. The sprinkler has a fire alarm attachment also, and announces the fire as well as holding it in check or extinguishing it entirely.

Standard automatic sprinkler systems, that is, with two sources of water supply, one of which is a tank, are of course the most efficient, but where the public water supply furnishes sufficient pressure, a single supply automatic sprinkler system should answer all the requirements for school protection. As special protection for basements, storerooms, work shops, and other probable starting places for fire, the sprinkler is strongly recommended. Most of these places are located on the lower floors and because of the slight pressure required, sprinkler systems could be installed at moderate cost.

CHAPTER L.

NEW YORK FIRE PREVENTION REPORT FOR SCHOOLS.

DEPARTMENT OF EDUCATION.
Building Bureau.

P. S.............
Borough of.............

Report on Building Conditions. With Reference to Fire Precautions.

New York, ...190......

SUPERINTENDENT OF SCHOOL BUILDINGS,
SIR:—

The following report is based upon a personal inspection made by me, and gives an accurate acount of the conditions found at

PUBLIC SCHOOL ....
Borough of ....
Located at ....*.............................
Inspected ...., 190...................
Last FIRE DRILL, held by Principal on (date).............
At which time of dismissal was............................
(Time given here to be that from first stroke of gong to time last pupil is in street.)
Name of persons witnessing and those who timed the dismissal..
....
....
....
Stop cock for gas in street or roadway......................
Location of any exit door or gate that does not open out......
....
....
....
Construction of ceiling over boilers or furnaces...............
....
If cellar be used for storage, give character of contents........
....

NOTE—Contents to be described as "chairs, desks and seats, other furniture, old books, lumber," etc. This also refers to attic on page 4.

....

Location and construction of janitor's storerooms............

....

Particulars of any wooden enclosure about machinery..........

....

....

NOTE:—It is thought desirable to cut off all communication between cellars or boiler rooms, and those portions of the premises, immediately adjacent or over the same which may be used by the pupils, the object being to prevent the passage of smoke into the school premises. Janitors to have outside stairways.

Cheapest and most effective method by which this may be accomplished, together with the estimated cost thereof...........

....

....

....

Classrooms on the 1st floor or in the basement which have not free egress are as follows:...........................

....

....

....

Size, location, and number of stories served by any fire-escape which terminates in yard..............................

....

....

....

The means of egress from the yard or foot of the fire-escape to the street is as follows:...............................

....

....

....

The use and approximate size of all frame buildings in the school yards is as follows:................................

....

....

....

Fire Alarm Telegraph..................No...............
Located ....
Key for Principal..................................
Key for Janitor....................................
Telephone ....
No. ....
Fire Extinguisher ....

Located ....
Fire Axe..
Located ....
Fire hook..
Located ....
Interior Alarm System..................................
(State number, kind and location of alarm and points operated from.)
....
....
....
Location of any swinging gas brackets.......................
....
....
Location of any wall gas brackets not provided with globe, cages or lanterns ....
....
....
Location, construction and use of any closets under stairs......
....
....
....
Number and location of any movable sash in storerooms......
....
Number and location of any storeroom sash not glazed with wireglass ....
....
....
Location of any wardrobe in which the coils or radiators are not protected by screens..............................
....
....
Location and description of any obstructions on stairs or landing ....
NOTE:—Inspector shall see that all chairs, desks, tables or other small movable articles are removed from stairs and landings before he leaves the building.
....
....
....
Location and description of any furniture that obstructs or narrows passageways used in dismissals....................
....
....
....

Location of any interior door that does not open toward exit. (Classroom, teachers' storeroom, wardrobe and closet doors excepted.) ....

....

....

....

Location of all gas stoves or burners connected to gas burner or gas pipe by means of rubber tubing..................

....

....

....

Location and description of any wooden chute or shaft extending up through the Buildings........................

....

....

Location of any exit without signs in assembly rooms and in halls and at stairs on each floor.............................

....

....

....

....

Location and description of any interior stair passageway less than 3'0" in width. ....

....

....

....

List of contents of attic if it be used for storage.............
(See note under contents of cellar.)

....

....

....

NOTE:—It is thought desirable to prevent the spread of fire in open attics by the erection of a partition covered with wire lath and plastered on each side so as to cut up the space into an area not to exceed 5,000 square feet. All communicating doors to be plank covered with tin and fitted with spring hinges.

The building under examination has (or has not) an open attic. Estimated cost of carrying out these requirements.........

....

....

....

Location of all wood ladders or steps used for access from top story to roof and estimated cost of replacing with those of iron ....

....

....

NOTE—This form to be used only in cases where Inspector has instructions to have a "Test Rapid Dismissal."

Report on a "Test Rapid Dismissal."

Dated .... 190...................... M.
Total time..
Time of 1st bell.
Taken by..
Principal in charge...
Persons present who witnessed the dismissal.................
....
....
....
....

REMARKS: ....
....
....
....
....
Height ....Stories ....
Feet Erected....................Altered..................
Construction ....
Owner ....
Seating capacity, 1st floor....2d.....3d.....4th.....5th.....
Actual number of pupils, 1st Fl.."......"......"......"......
Location of Assembly..
Open or divided...
Stairways. (Give number, location, construction, and floors served.) ....
....
....
....
....

Fire escapes, width and number of stories served by each.......
....
....
....
....

Special Conditions.

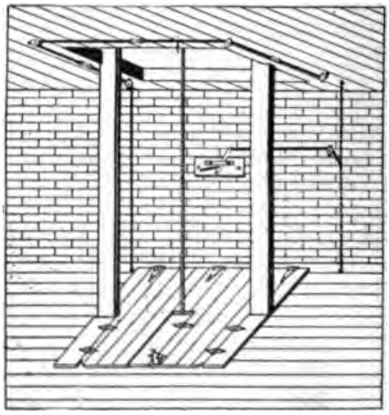
....
....
....
....
....

Recommendations.

....
....
....
....
....
....

Respectfully submitted,
(Signature).......................
(Title).........................

October, 1908.



CHAPTER LI.

FIRE PREVENTION FOR HOMES AND RESIDENCES.

Beware! the Fire Fiend.

FIRE is a never idle Fiend. Every hour of the day and night, he plies the torch. In New York City, he sets fifteen thousand fires a year. The lonely farm house, the crowded tenement, and the millionaire's mansion are all alike to him. No one is safe, and no place beyond his reach.

At night the Fiend does his worst. When the family are asleep, he opens a crack in the chimney. A spark leaps out, one is as good as twenty. The Fiend sees it and goes on his way, who knows where? To a factory, a store, a hotel, or some other home?

The spark (the Fiend's handy man) meanwhile is eating up some paper. The paper turns to flame and the flame fastens on wood, and lo, Fire is made. It is still young and growing, and it needs air, plenty of it, with a good draft back of it. It starts out to find this air. Up along the wall it travels, then across the ceiling until it finds the open door. Once through the door it has the stairway and Fire will go upstairs quicker than any mortal being ever did.

It will not only go up stairs but it will come down again, if it cannot get out through the roof. On its return journey, it stays on the top floor and visits every room, then comes down to the next floor and enters the bed rooms. By the time it has turned on itself and completed the circle, its work is done. The firemen can come with bells and whistles, they can use their hose, their hooks, and their axes, but Fire has left its work, a black mark that tells its own story about the house.

What of the family? Sometimes Fire is kind. It has a messenger, smoke, that runs ahead and gives warning, "The Fire is coming." It may tickle the nose, or catch the breath, and when the eyes open, whisper, "Run for the stairs." It is a race between Fire and the Family. Smoke may lull the family to a deeper sleep, or it may rouse them, and then there is a race for the stairs. Sometimes the family wins and gets down stairs before Fire goes up. Sometimes Fire wins; then the family goes to the window, perhaps to go down ladders, perhaps to jump, perhaps to stay behind.

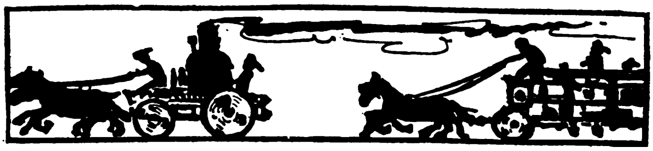
The Fire Fiend is as old as the world, and he is getting worse instead of better. He loves a theater at Christmas time, so in 1903, he picked out the Iroquois Theater in Chicago and in five minutes choked and blackened 500 women and children, more than he had ever done in a theater before. A crowded steamboat on a church picnic, is also a favorite, so the story must be rehearsed of the "General Slocum" with nearly a thousand persons, women and children mostly, to be added to the record.

Hotels, too, never shelter a more frequent guest. All the year, but summer time especially. One summer he visited the Long Beach Hotel and turned a thousand people out on the Long Beach sands. He went down to Maine and swept away the famous old resort of Old Orchard. Of city hotels, the Windsor Hotel in New York, was a world wide catastrophe, while every town and city has its own hotel horrors.

Cities and towns even do not escape. Baltimore, Rochester, Toronto, have had their conflagrations. In San Francisco Fire out-horrored the Earthquake, and to-day the question is, New York next, or Boston, Chicago, or what city East, West, North, or South?

What does Fire cost in money? Start with the annual average insurance loss of $150,000,000. Add to that the $100,000,000 that the insurance companies charge for handling this Fire tax. Next add what the public Fire Department costs, (in New York City, the Fire Department is costing Ten Million Dollars) then add the money spent for private fire protection, and finally, the loss of property that is not insured, and the loss that the business man feels when his business is broken up and ruined. The grand total is easily a half a billion dollars, almost as much as it costs to pay the expenses of our National Government.

Are you prepared for the Fiend? Is your house safe against him? Do you know what to do if you find him in it?



CHAPTER LII.

WHAT TO DO IN CASE OF FIRE.

FIRE is one of the household troubles that have to be met by the women of the family. Most fires probably occur when the men are away. The small fires can be put out by a quick witted woman almost as well as a man. The large fires have to be left for the firemen anyway, so a woman might as well learn how to act when fire happens.

Fire is a small thing at first and burns slowly at the start. It will usually allow you a few minutes for action before it gets dangerous. Try to make the most of this little delay. You can do many things in a few seconds, if you keep your wits and have learned some simple rules about handling fires.

Remember that most fires can be prevented. For your own sake and the sake of your family, you should consider this in your housekeeping. For the fires you cannot prevent, you can provide protection. That is the purpose of this present article. It is to offer some practical suggestions on what to do when fire occurs. Memorize the important things. Tack up a card with directions to be followed in case of fire. They will be studied before the fire and probably acted upon at the needed moment. Here are a few things worth knowing.

Send the Alarm.—First of all, send the alarm, no matter how small the fire is, or even if you think you have put it out, call the firemen, or get assistance. If you send the alarm first, you will not lose valuable time, if the fire spreads. You also cannot be too sure that the fire is out.

Find out where the nearest Fire Alarm Boxes are, the location of the nearest Fire Department Company, and the telephone number of Fire Department Headquarters. Put all this information on a card, and tack the card up near the telephone, or in the hall near the street door. See that every person in the house understands this Fire Alarm sign.

Send the alarm in two different ways. Use the regular Fire Alarm Box first. The Fire Department places more dependence on this. Then use the telephone, and if you can, send a messenger to the fire company, if it is near. If it is just suspicious smoke or a chimney fire, use the telephone. Be sure and give the address plainly. Firemen want to know the location of the fire, not the name of the people. There may be several families of your name in the town. Just state, "Fire at 66 Jones Street."

Be sure you know how to use the public Fire Alarm Box. If you don't know, ask the officer in the nearest fire company. He will gladly show you. Instruct every member in the family in this simple action. Most people think they know until the time comes and then make a mistake.

Smother the Fire.—After you have sent the alarm, then think of fighting the fire. If you cannot attempt to fight the fire, try and close the doors. Shut it up in one room, in a closet or on one floor. This will keep it from spreading, give the firemen time to arrive, and allow everyone to get out of the house.

Shut Off the Drafts.—Whenever the fire is too large, or you cannot attempt to fight it, close doors and windows around and below it. Shut off the drafts. It is the updraft that makes a fire burn so fiercely. Don't go above the fire. Don't pass the fire. Don't go back after you have reached a place of safety.

Get everyone below the fire at once. If the house is large, put in an interior fire alarm. You should have bells and gongs that will ring on every floor. You can get an electrician to wire the house and put in the switches or push buttons which in case of fire can be operated on any floor and ring bells throughout the entire house. This will save some seconds in notifying people in the house and may save enough time to allow everyone to get out safely.

The Home Fire Brigade.—Have the men and boys form a Fire Department and go through drills. See that everyone has a part to do when fire happens, that all know where the alarm box is and how to send an alarm. Keep the wash tubs or bath tubs filled, or some pails of water on every floor. Have some brooms handy. The best place for all fire extinguishing tools are near a doorway or at the head of the stairs. This means that whoever is to fight the fire reaches a place of safety first and then goes back to fight the fire. The way of retreat is open; he can escape without having to pass by the fire.

CHAPTER LIII.

WHAT IS FIRE?

FIRE is smoke, flames and heat.

Smoke. Smoke is a mixture of air, gases and solid matter.

The air in smoke is air that has been warmed by the heat of the fire. This makes it lighter than the surrounding air and so it arises above the fire. The rising of heated air from a fire is the draft.

The gases in smoke are the gases that have been roasted out of the material by the fire, but have not taken fire or become lighted. Gases are light, so they rise above the fire and mix with the smoke.

The solid matter in smoke is particles of the burning material, which have not been entirely burned; they are light enough to rise into the air and be carried above the fire by the draft. It is the half burned particles that give color to smoke.

Flames. The flames which are a part of a fire, are gases that have been lighted or are burning. The flames are the blaze; it is also the flames that make the light, which a fire gives.

Why Does Fire Occur?

Oxygen. Fire occurs because a gas known as oxygen mixes with things.

What is oxygen and why does it mix?

Air. Oxygen is a gas that is colorless and odorless. With another gas known as nitrogen it forms air. Air is four-fifths oxygen and one-fifth nitrogen.

Water. With another gas known as hydrogen, oxygen forms water. Water is eight-ninths oxygen and one-ninth hydrogen. Oxygen makes up more than one-half of the earth.

Breathing. Men and animals cannot live without oxygen to breathe.

Oxygen mixes with things because it is its nature to do so. It will mix with almost everything in the world. When oxygen mixes with a thing, heat is produced. If the mixing is done slowly, only a little heat is produced, and this passes off without a change being noticed. If the mixing is done quickly, a great deal of heat is produced; a change takes place and we say that the thing is on fire or is burning.

Rust is a good example. Everyone knows that iron rusts, the result of oxygen combining with the metal. If oxygen can eat away such hard material as iron in a short time, it is little wonder that it can burn up paper, cotton and wood almost instantaneously. Rust is slow fire and fire is quick rust, is one way of expressing the process. When oxygen is attacking or combining with a material to its destruction, heat is produced.

When Does Fire Occur?

Fire occurs when there is heat enough. What is heat enough to make a thing burn depends upon the material it is made of. Some things will take fire and burn with little heat; others need great heat.

What is heat? Two answers can be given to the question.

Heat is a sensation or feeling; it is something that a person feels.

Heat is a state or condition of a thing, which makes the sensation or feeling of heat.

Heat is really a form of motion known as vibration. All bodies, substances or things are made of small particles known as molecules. Molecules are so very small that they cannot be seen by the human eye, even with the help of artificial means of increasing sight, such as the magnifying glass and the microscope. Even if molecules cannot be seen and it cannot be proven that there are molecules, it is a fact that most men of science believe in molecules. When scientists agree that a thing is so, ordinary people believe it is also, because they have faith in the knowledge of scientists.

It is believed that all bodies are made of molecules, and it is also believed that these molecules are moving in a way that is known as oscillation or vibration. This means that a thing is shaking or moving to and fro, but not really changing from a fixed position. It is this moving or vibration that makes what is known as heat. If the vibration is very rapid there is great heat. If the vibration is slow, there is little heat. The hottest bodies are those with the greatest vibration. A hot body placed near a cold body gives some of its vibration to the cold body; it increases the vibration of the cold body.

The vibration of a body can be increased or reduced. It can be passed from one body to another. The way in which this is done are the ways in which heat is spread or increased.

How is Heat Produced or Increased?

Heat is produced, or increased, in the following ways: By friction, by absorption, by percussion and by pressure.

Examples of heat by friction are the striking of flint and steel, or matches, the rubbing together of tree branches, the rubbing of metals, amber, india rubber, the working of a saw, a gimlet, or boring machine, whether in wood or metal, as are also, the skidding of wheels of vehicles, the application of brakes to railway trains, and many other instances.

Examples of heat from percussion are found in percussion caps, and in the heating of horseshoe nails, and bodies generally, by hammering. An expert smith can readily hammer a horseshoe nail to a cherry-red heat; while the impact of a solid shot, travelling at a high velocity, against a sufficiently resisting target, will develop enough heat to melt the shot.

In firing shot at an iron target a sheet of flame is frequently seen at the moment of impact.

Examples of heat from pressure are:

The cold punching of metals.

The increase of temperature in metallic pillars, when weights are placed upon them.

Heat produced in the compression of gases.

In the gunpowder ram used for driving piles, the powder is ignited by the compression of the air in the mortar fixed to the head of the pile.

If a body be so compressed that its density is increased, its temperature rises according to the diminution of the volume.

Examples of heat from absorption are the following:

Whenever a liquid is poured upon a finely divided solid, an increase of temperature is produced, varying with the nature of the substances With inorganic substances, such as metals, the oxides and the earths, the increase is four-tenths of a degree; but with organic substances, such as, sponge, flour, starch, roots, dried membranes, etc., the increase varies from one to ten degrees.

How is Heat Measured?

Heat is measured by a thermometer, which consists of a graduated scale and a quantity of mercury in a glass tube with a bulb at the bottom. When heat is applied to the glass tube, it causes the mercury to expand, and it arises in the tube, a certain distance according to the degree of heat. The graduated space represents so many degrees of heat, according to a fixed scale.

Thermometers are designed to graduate between the boiling and freezing points of water. The Fahrenheit thermometer starts thirty-two degrees below the freezing point and runs up to two hundred and twelve degrees for the boiling point. The Centigrade thermometer starts at the freezing point and is graduated to 100 spaces up to the boiling point. The Reaumur thermometer starts at the freezing point and is graduated to eighty spaces to the boiling point.

CHAPTER LIV.

HOW TO PUT OUT A FIRE.

FIRE is a very tricky and dangerous thing and this article is not meant to encourage people to think that they can do without the aid of trained firemen. If you have a Fire Department within call, SEND THE ALARM FIRST, THEN FIGHT THE FIRE.

Many fires in homes can be put out without calling the firemen, while the people in small towns, villages and country districts have no trained firemen to depend upon, so these suggestions are intended for the benefit of those who have to be their own firemen. It is not necessary to tell people how to put out little fires that they stamp out by natural instinct, nor is there any sense in telling them about fires that have such headway that even the best Fire Department can do no more than play water on the flames. But between these extremes, there are many fires that a few practical hints on fire and fire extinguishment, as well as the use of simple appliances may be the means of putting out and preventing what would otherwise be a destructive fire.

Fire is put out by smothering it or by putting water on it. The first method shuts off the oxygen (the gas in the atmosphere, without which there is no fire); this is the reason why stamping out or beating a fire puts it out just as a blanket or heavy covering thrown over a fire extinguishes it.

Water puts out a fire, because water absorbs so much heat that it reduces the temperature of the material on fire below the burning point, so that fire cannot exist.

Fire travels and spreads according as it is fed by air, so that the first simple rule to remember is; SHUT OFF THE DRAFT, that is, close the doors and windows around and below a fire. In other words, try and shut up the fire in a closet or a room until you have your water pails and extinguishers ready for use. If you shut off the draft, the fire will burn slowly and give you time to get ready to fight it.

Many of the little fires in homes are the kind that can be put out by smothering them. People instinctively stamp or beat out a fire, as soon as they see it. This is sometimes dangerous because the clothing is likely to catch fire or the hands be burnt, so it is better to use a cloth, a broom, or some other object to put out even the smallest fire. If a blanket or other covering is at hand, this should be thrown over the blaze.

If the fire cannot be put out in this way, don't get excited; in 99 cases out of 100, there will be time to get a pail of water and other extinguishers. For the first few minutes, the fire will burn slowly. Shut off the draft by closing the door; by the time you have sent the alarm or called assistance, the fire will still be within control. Get the people in the house on the floors below the fire; they will be safe there or safe, if they even reach a stairway which is away from the fire.

Most dwelling fires can be put out with a pail of water and a broom. Dipping the broom in a pail of water, is better than throwing the water. It is not easy to throw a pail of water accurately and if the water does not reach the fire, there may not be time to get another pail. A broom holds a lot of water, it is surer, it will cover more surface and it is the best thing to stop fire travelling along quick burning stuff, such as curtains or hangings. A lace curtain on fire, for instance, can be reached with the broom and pulled down on the floor and the fire beaten out by the wet broom. This is the best way to handle a curtain fire, as it will save getting the hands burnt in pulling the curtain down.

For a closet fire, a piece of burning furniture or a bed, the broom is just as useful. In fighting fire, another simple rule is: GET THE FIRE ON THE FLOOR. Here it will not burn as rapidly as when suspended or raised up since it has not the draft beneath it. With clothes on fire, or other burning stuff, the broom can be used as a hook to knock them on the floor where water can be more easily put on the flames. In case of a bed on fire, the best thing is to upset the bed and get it flat on the floor, then the wet broom can be used to beat out the fire, or the mattress bundled up and thrown out of the window.

Chimney Fires.—Water should not be used to put out chimney fires; sand or coal is sometimes thrown down the flue but this is liable to choke the chimney. Salt is the best thing to be used and a couple of pounds of salt thrown down a flue will put out almost any chimney fire. The crackling and explosion caused by the burning of the salt, loosens the burning soot which falls down on the hearth or chimneyplace where a pail of water should be ready to throw on it.

The great danger from a chimney fire is that the fire may get into the plaster or the floor through a crack in the bricks or be started by the heat. After a chimney fire is out, the house should be carefully examined to make sure that the fire has not gotten into it. Be sure there is no smoke in the rooms because there should be none and if there is it means that the fire is burning somewhere. In this case, the way to proceed is explained under the subject of Hidden Fires.

Hidden Fires.—Be careful about suspicious smoke. A hidden fire will give off smoke for hours, and days even before showing itself. If there is smoke in the house that you are not sure is caused by the stove or furnace, or coming in from outside, call in an experienced fireman, if you can get one. If you have to depend on yourself, be sure that you find the fire or be extremely watchful. There is no smoke without fire and the continued presence of smoke in a house means that somewhere a fire is slowly growing.

Hidden fires are usually found between the floor boards and the ceiling, in partitions back of the plaster, or they may be in some closet, storeroom, attic or place, where odds and ends are kept. In most cases, they are caused by heat from the stove, furnace, chimney, steam pipes, electric light wiring or possibly by mice who have carried matches into their nests and lit them.

A hidden fire may often be discovered by running the hand over the surface of the wall or floor, and sometimes it may be located by watching how the smoke travels. Smoke rises until it reaches the top of the house and then if it cannot get out it will turn on itself and work its way down again to the lower floors. If the smoke is found to be coming from one room and the fire cannot be found by feeling about by the hand for a hot place, the source of the smoke may sometimes be located by darkening the room and using a bull's eye lantern or lamp reflector, the rays of which will catch the smoke as it issues from the hiding-place of the fire.

Fires in between the floor, back of the plaster or in walls or partitions are very dangerous; unless discovered and put out, they will finally spread all through the house or burst out and start a large fire in the rooms. A great deal of fire will be concealed back of the plaster and in handling such a fire every preparation should be made before the fire is attacked. Pails of water, chemical extinguishers, hose, hooks and axes should be right at hand. It may be necessary to chop up the floor or pull out lath and plaster with a fireman's hook, but this wrecking is the only way to get at the fire and put it out, as well as to be sure that it has not extended to the floor above or spread sideways several feet beyond the spot where it appeared to have started. Fire has a trick of leaping across spaces both vertically and horizontally, so a little extra tearing up of woodwork and plaster is a very necessary precaution.

Fire Pails.—A pail of water is the simplest fire extinguisher. It is used in all business buildings. Why not in homes and dwellings? It costs only a few cents and requires very little attention. The time saved in running for a pail and getting it filled may be enough to catch a fire, when it can be easily put out.

A single pail on each floor of a house gives a lot of protection. Some place can be found for it where it will not be in the way. If kept covered, it will not need refilling very often. But of course some one must look after it and see that it has water in it.

Buy the regulation Fire Pail, which is painted red and has the letters "Fire" on it. Get the best quality of pail, that is with the best galvanizing. It will last longer. The 10 quart size is best for homes. Buy covers for the pails. Don't buy round bottom pails.

Put the pail on a hook, a bench or a shelf. This will keep it in its proper place. Place it near a doorway, or at the head of a stairs, that leads to a safe place. The reason for this is to have the person who is to use the pail first reach a place of safety and then return to fight the fire. The amateur fireman must have his way of retreat open. He must not run the risk of being cut off by the fire. Therefore don't place pails or extinguishers in a spot, where to get at them, you must cross or pass beyond the fire.

Some good substitutes for filled pails are a Bucket Tank, which contains pails inside or a good oak barrel, with empty pails nearby. So also is keeping the wash tubs or the bath tub filled.

Practice throwing water from a pail. Learn the knack of throwing a broad sheet of water with a semi-circular sweep. You can cover a lot of space if you learn the trick. Get a sailor or a man who knows how to wash wagons to show you. Don't try to throw a full pail over your head. You will spill most of it and not reach the fire. Empty some of the water and you will do much better in throwing water upwards.

In working at a fire, don't throw a pail of water in one wild shot, unless the fire is so hot that you can only stay for one attempt to hit it. If you miss the fire, you may not have time to get another pail. Or you may scatter the burning stuff and spread the fire quicker than you can put it out. Dip the water out with your hands or a brush, sprinkle the fire, or pour the water on it. This will often do as much good as trying to drown the fire. After you darken the fire, that is put out the flame, stir up the material on fire, or wait for the flame to show itself again. This is better than soaking the fire, that is, using water when you don't know if it is reaching the body of the fire. Remember a good fireman prides himself on putting out a fire with little water.

Extinguishers.—These have some advantages over pails and are preferred by many people. But their operation ought to be understood, and some practice had in handling them. There are three different types of extinguishers made for general use, that is by persons who are not regular firemen, Tank Extinguishers, Syringe Extinguishers and Tube Extinguishers.

Tank Extinguishers.—These are what is generally called a Chemical Extinguisher. It is a copper tank with a small hose attached for directing the stream. It is made in several sizes, the two and a half gallon size being intended for use by the general public. The larger sizes are for Fire Department use.

The popular size extinguisher has no valve or shut off on the hose and holds 2½ gallons of water. What makes the tank extinguisher of use is that the water can be thrown some distance, say 25 to 50 feet. This is done because the water is under pressure when the extinguisher is being operated. The water is put under pressure by generating a gas within the tank. The gas is made by mixing sulphuric acid and bi-carbonate of soda. The soda is dissolved in the water and the acid put in a bottle, held upright at the top of the tank. By upsetting the extinguisher, the acid is gradually fed into the water and by chemical action, carbonic acid gas is formed. This gas is the soda water gas used to make soda water fizz or effervesce, and when taken from a soda fountain, a vichy bottle or a tank extinguisher, it comes out with great force. This is due to the gas trying to escape from the bottle or tank. As it forces its way out, it carries the water along with it. It is under pressure, as the engineer terms it, as much as 200 pounds per square inch.

It is true that soda water gas is a good fire extinguisher. But it must be remembered that the gas is used in the tank extinguisher to put the water under pressure, not to extinguish fire. The tank extinguisher is a water extinguisher, not a gas extinguisher. In using it, depend on the water, not the gas to put out the fire. This will prevent misunderstanding and may save you being fooled some time, when you think you have put out a fire.

In buying tank or Soda and Acid extinguishers, be sure and get the National Board standard machines, all of which now have the inspection label of the Underwriters Laboratories, Chicago. These machines are safer and more reliable than non-standard machines. They have the recommendations of being designed for use by the general public, constructed according to specifications, and manufactured under supervision.

After buying a tank extinguisher, discharge it a few times, so as to become familiar with its workings. Have all the members of the family and the servants become experienced with it. It is too heavy for use by most women but a strong woman and men and boys can use it. In experimenting with this extinguisher, better wear an old suit of clothes, and don't throw the liquid on anything that it may damage. Sometimes acid comes out with the stream, or the soda solution may do some damage. Here are a few points on handling the machine.

1. Carry the machine right side up near the fire. This means to the door of the room, or to the head of the stairs of the floor on which is the fire.

2. Take the end of the hose in the right hand. Hold on to it all through the operation. Keep it pointed away from you.

3. Turn the machine over on its side. Use both hands for this.

4. Grasp the handle at the bottom of the machine with the left hand. Turn the machine on its head and the stream will start. To stop it, turn the machine back to its right position.

5. Play the stream at the bottom of the fire, that is the burning material. Don't waste water on the smoke or flames. Hit the body of the fire.

6. If the fire is travelling upward, give it one dash at the bottom, then turn the stream at the top of the fire and work downwards, or across if the fire is going in this direction.

Syringe Extinguisher.—This has some advantage over the tank or soda and acid extinguisher. It is small, weighs only four pounds and can be used by everyone. It contains a quart of chemicals, which make an extinguishing gas, when thrown on the fire. The liquid can be thrown on silks, paintings, foods, or any material without damage. The gas can be breathed without much ill effect.

The extinguisher is constructed like a syringe or hand pump. It contains only one quart of liquid, but this makes 290 cubic feet of extinguishing gas. It is the gas, not the liquid that puts out the fire.

The syringe extinguisher discharges only ⅝ ounce of liquid at each stroke, but a few discharges of the machine is enough for most home fires. The hand pump throws the liquid from 25 to 30 feet and this is far enough to reach most incipient fires. A person can stand at the door of a room and work the machine. If the liquid reaches the flames or heat, the gas will do the rest.

What is called the DRY POWDER extinguisher is a long tin tube filled with chemicals, in the form of powder. This powder, when thrown on a fire, produces a gas that literally suffocates the fire. That is, this gas forms a blanket over the fire and shuts off the oxygen in the air which the fire must have in order to burn.

The dry powder extinguisher is used by throwing with force, the powder in the tube onto the fire. It can be used for a chimney fire by burning the powder at the bottom of the flue which is on fire; it can be used for a closet or box on fire or when the fire is in a confined space. In this case the extinguishing gas is confined and gets a chance to do its work which it cannot do when the fire is in an open space such as a floor, hall or room, because the gas escapes into the air. It, therefore, does not form the blanket by which it shuts off the oxygen and smothers the flames. The powder has also been used on gasoline fires and in many cases has done good work, but a warning is necessary about these extinguishers. As has been said they are good for some fires but their value has been greatly exaggerated and most fire protection experts do not recommend them.

CHAPTER LV.

HOW TO PREVENT FIRE.

Common Causes of Fire.

WHAT are called the common causes of fire are those due to carelessness, ignorance, bad management, bad housekeeping or bad habits. A list of these is as follows:

Dirt, dust and rubbish; storage in closets, cellars and attics; oils, paints, greases and fats; gasoline, benzine and naphtha; kerosene oil; stoves; condition, good order and repair; smoking; ashes and cinders; celluloid; gas; gas stoves; stove or smoke pipes; steam pipes; matches; drying clothes and laundries.

Dirt, Dust and Rubbish.—A dirty house burns faster than a clean one. Dirt and dust are a help to fire in getting started and spreading. Dust burns like powder, and when there is enough of it to be stirred up by the draft of the fire, an explosive condition is created by the fire. This happens in buildings of large area, either great length or breadth, or of great height of the rooms, such as exist in theatres, churches, car barns, piers, ferry houses and railroad terminals.

Rubbish in a pile or heap or loosely scattered about makes a bonfire waiting to be lit. A spark from any source, a match thrown down, a dropped cigar end or cigarette, any increased heat, any actual and direct cause of fire is enabled to do its work just because the rubbish is there to be operated on. Without dirt and rubbish, most of the direct starters of fire would be made harmless.

It is not alone that dirt and rubbish are handy to start a fire, but they are ready and waiting for a small trail of fire that is looking for something to feed on. Many fires that are started and spread would die out harmlessly if they did not reach a convenient pile of rubbish. Then the thin trail of flame bursts into a full grown fire, the entire room or floor is filled with smoke and flame and there is no proof or evidence of how the fire started. If someone had been there at the start, they would have seen the first spark or flame and would have been able to detect the real cause. Many if not most fires that have to be put down as not ascertainable are probably explainable in this way. Certainly every fireman can tell of numerous cases where fires were caught before they had spread beyond their starting point or had left their trail to indicate their beginnings.

What is true of dirt and rubbish in starting and spreading fires inside buildings is equally true of outside fires. In case of fire in adjoining, nearby or distant buildings, dirt and rubbish are a great factor and the conflagration in Sioux City is said to have been due to rubbish and old wood in the rear yards and open spaces.

Classes of Rubbish.—Rubbish is a general term for any accumulation that is undesirable from a fire standpoint. There are several classes of rubbish that are worth while remembering; such as,

Dust, sweepings, scrap paper, waste paper, sawdust, shavings, old furniture, mattresses, trunks, boxes, barrels, crates, lumber, packing material, excelsior, hay, straw, paper, rags, old clothes, cloth clippings, ashes, cinders, coal, fat, grease, bones, kitchen refuse.

Rubbish Places.—Rubbish is generally found in certain places, and for convenience sake, a list of the most common places is given herewith:

Yards, courts, alleys, areas, under sidewalk gratings, bottom of shafts, closets, storerooms, cleaners, janitors' and engineers' rooms or quarters, under stairs, in corners, back of counters, desks, tables, benches, toilets, washrooms, cellars, basements, attics, garrets and roofs, on steam pipes, furnaces, boilers and stoves.

Precautions Against Rubbish.—In order to prevent rubbish becoming a fire danger, the best thing to do, if possible, is to have no rubbish and to keep the place where rubbish accumulates entirely clean. This cannot always be done, of course. Rubbish must be kept for a small space of time and frequently it must be stored. A regular inspection of rubbish places is one of the best safeguards and for this purpose a list of places where rubbish accumulates or is stored should be made to be sure that when the inspection is made, no place will be overlooked.

The cleaning up of rubbish places and the whitewashing of walls and ceilings is recommended, because if a place is clean and whitewashed, it is easier to see what is in it, to discover smoldering fires, and in addition, the whitewashing acts as a fireproof or fire retarding material.

The use of metal cans as receptacles for small quantities of rubbish is a good precaution, while for large quantities, which cannot be handled in cans, the construction of metal or metal lined bins is advisable, while if the accumulation is even too large for bins, a special fireproof room should be used. Where excelsior, hay, straw or paper is used for packing purposes, a fireproof packing bin should be provided. This can be either of metal entirely or wood with metal lining, which preferably should be lock-jointed tin. The bin should have an automatic cover held back by a fusible link, which will release the cover in case of fire.

In all places where rubbish, excelsior, hay, straw, paper, cotton, or other inflammable materials are used, all lights should be covered or protected. The incandescent electric light is best, but if electricity is not installed and gas is used, the gas jets should be enclosed in glass lanterns, what are called stable lanterns, or if this is not done, then at least wire cages should be fitted to the gas burner.

Storage in Closets, Cellars and Attics.—This is a housekeeper's privilege and probably cannot be interfered with, but it results in many fires and serious fires. They start unnoticed, have plenty of fuel at hand and the best kind for a quick spreading and intense fire.

To prohibit storage altogether is an extreme measure, but that is what the fire inspector would like to do. It is the only sure way to prevent storage fires. Few houses have any spare room for storage, except the attic or the cellar.

Don't use the cellar whatever you do. Most dangerous fires start there and spread through the house. They, too, also result in people being injured or killed. If you must store in the house, use the attic. A fire starting there may burn down the house, but that is better than burning it up. The attic is a bad place, because it is usually extra warm there. The warm air in the house rises there, while the sun beating on the roof helps to raise the temperature. Usually, too, the chimney passes through the attic and contributes a lot of heat.

Keep the storage of old and unused articles down as small as possible. Weed them out at every spring cleaning. Don't keep excelsior, hair, straw or old mattresses. Don't have open boxes or barrels containing paper or inflammable stuff. Nail them up with covers. Keep the different articles as separate as possible. Don't have the place overcrowded or packed so tight that you cannot move about in it and examine it to see if any fires are getting ready to start. Watch for mice building nests with matches, or fires started from matches left in clothing. Keep the place ventilated. This will reduce the temperature and help to prevent spontaneous combustion. Whitewash the walls and ceilings. This does away with cobwebs, inflammable dust, and fireproofs the room.

Don't have store closets or rooms in halls or under or near stairways or other shafts. Remember the stairway is your fire escape. Don't make it easy for the fire to reach the stairs and cut off your escape by smoke and heat filling the stairway. Place the store closets or rooms away from the stairway. Use an outside room if you have one to spare. This will give more light and help in having the fire discovered when it starts. If there are glass windows, panels or transoms in the store room, change the glass to wire glass. This will hold the fire some minutes longer than plain glass and give you time to call the firemen, or get ready to fight the fire yourself.

Oils, Paints, Greases and Fats.—All these should be kept or stored outside the house. Use a special box or bin, or a shed to contain them. If it takes fire, then it will not endanger the whole house.

Above all things, don't keep them in the basement or cellar. This is the one worst place. In a closet or room under or close to the stairs is just as bad. This is the reason for fatal fires and fires that burn down the house without giving the firemen a chance. They start unnoticed and spread through the house before being discovered and cut off your escape. The attic is just as bad a place, except that the fire is above and works down instead of up.

If you do keep these things in the house, find a place that is naturally cool and ventilated, that is, not tightly closed so that the air does not circulate throughout. See that it is not near any heat, or in a position to be heated by the sun's rays. Have it easy to get at in case fire starts there, and that the fire cannot get to the stairs quickly, in other words, have it cut off or fire stopped. Also have it in plain sight and likely to be looked at often.

Remember the difference between the various oils. All burn freely and help a fire. Gasoline and its first cousins, benzine and naphtha, are dangerous because of the explosive vapor they give off. Animal and vegetable oils are dangerous because they start fires by spontaneous combustion. Linseed oil (used in nearly all paints), cottonseed oil, olive oil, lard oil, machine oils, greases and fats in general, when put on cotton, silk, sawdust, excelsior, straw and other stringy or chopped up materials, can be depended on to start fires when you are asleep or off visiting.

Therefore; Burn up ham bags, rags, paper or cloth rubbed with lard or butter, butter or grease cloths used to wipe sewing machines, lamps, or fresh paint. Don't put them in the ash barrel, rubbish heap, waste paper pile, refuse cans, sweepings, or any stuff that will burn. The stove or the furnace is the only safe place. Beware of mops used to clean oily floors. Find out what floor oils or compounds are composed of. Many of them contain kerosene, or something else that is bad when fire starts.

Condition, Good Order and Repair.—The physical condition of a building is a factor in the spread of fire. If there are holes in the floors, partitions or ceilings, it means openings for the *fire* to travel through quick and also reach covered or concealed places where it can spread unnoticed and where it is difficult to get at for extinguishing. If doors are missing from rooms or floors, the same thing is true.

A list of building defects that help the spread of fire is as follows:

Broken plaster with wood laths exposed on ceilings, partition walls, and side walls. Holes in floors, broken floor boards, worn out boards and boards cracked and split. Doors missing, holes in doors and glass panels broken or out. Broken windows, particularly cellar windows. Broken skylights.

Smoking.—This is responsible for many fires in homes and elsewhere. It is probably useless to think of prohibiting it, so try and educate the smoker to careful habits. Here are a few suggestions:

Don't smoke in bed. Don't throw away lighted match sticks. Place them in a safe place and hold them until the glow has died out entirely. Don't throw away lighted cigar or cigarette stubs or pipe ashes. Put them in a safe place. Don't throw them into waste paper baskets, wooden spittoons, down cellars, in rubbish piles. Don't lay lighted cigars or cigarettes on paper, wood, cloth or celluloid. Don't use any matches in your home, except the safety match.

Ashes and Cinders.—Keep them separate from everything else. Don't mix them with paper, rags, sawdust, rubbish, sweepings, kitchen scraps, wood or any stuff that will burn.

Don't put them on wood floors, in wood boxes or barrels. Metal cans with covers are the only proper ash holders.

Don't put them in halls, closets, rooms or dumbwaiters. If you store them in the cellar keep them clear of wood, above, below and on the side. Watch the ash pile, it will take fire of itself. Bits of charcoal or coal are left in it, or it may get wet from the rain, or from the moisture in damp cellars.

Don't place ash piles outdoors against boards, fences or wooden houses.

If your house is on a cinder foundation, watch for fire or smoke from it.

Celluloid.—Don't use celluloid articles if you have any regard for your safety. This material is positively the most dangerous found in homes to-day. It is made of a high explosive, that is, gun cotton (cotton soaked with nitro-glycerine) and camphor. It takes fire from the least heat or a spark, and if much heat is suddenly applied, it explodes. Some of the things that will set off celluloid are: a heated curling iron or a flat iron; a gas jet, an electric light bulb, a match or lighted cigar.

It is used to make all kinds of articles in imitation of tortoise shell, amber or ivory. These are pretty and inexpensive, so there is hardly a home or a dresser which has not some of them. But they are terribly dangerous and responsible for many painful and shocking accidents. Some articles made from celluloid are as follows:

Hair combs, nail brushes, tooth brushes, shaving brushes, manicure sets, collar and cuff boxes, handkerchief boxes, soap boxes, knife handles, plates and trays, baskets, corsets, book covers, playing cards, billiard balls, collars and cuffs.

Gas.—Don't have short brackets. The flame should not be nearer wood or lath and plaster than six inches.

Don't have gas jets close to ceilings; twenty-four inches is the safe distance and then they should have overhead protection, such as porcelain bells, or metal plates swinging over them. If the gas jets must be nearer than this, protect the ceiling with a permanent shield, such as a piece of tin with air space.

Don't have open gas lights; protect every jet with a glass globe, a wire cage or a box lantern. In stables or wherever straw, cotton or excelsior is handled, only box lanterns are safe.

Don't have brackets with hinges. Swinging or folding brackets are never safe and are prohibited by law. Do away with them entirely if it is possible, if not, then make them rigid by tieing them fast with wire and in every case put wire cages on them.

Don't have gas jets in closets or storerooms, under shelves, over excelsior or waste paper bins.

Gasoline, Benzine and Naphtha.—These three fluids differ slightly, but from the fire standpoint, they are to be treated alike. The fluids burn fiercely, but they don't explode. It is the gas or vapor given off by them that explodes. They give off vapor rapidly and at ordinary temperatures. This vapor mixed with air is explosive. The vapor travels everywhere; it sinks instead of rising like most vapors, so it will be found downstairs, when the fluid itself is on the upper floor. It will seek out a light or fire in rooms some distance away and explode itself, that is, the fire will flash back, or reach the fluid and not only explode, but start a serious fire. The vapor is very tricky and practically impossible to keep within bounds. This explains the many gasoline fires, "with no light or fire near the gasoline."

There is only one safe rule for gasoline: Don't have it in the house. Most people use a little of it for dry cleaning. Better find some other cleaner, or send the things out. If you do use the stuff, here are a few directions that will help:

Buy as little as possible.

Keep it in a safety can, that is, a can that has a spring top or cover, which closes automatically, after you have stopped pouring out the gasoline.

Keep the can labeled; don't mistake it for kerosene.

Keep the can in a cool place, outside if possible. Keep it away from stoves, lights, fires, or heat of any kind.

Use the gasoline in the daytime and outdoors if possible.

Don't use it near lights, fires, flame or heat of any kind.

Ventilate the room after using gasoline. Let the fumes pass out into the open air, not into the house.

Don't empty gasoline into sinks or into drains; the vapor will come back. Throw it on the ground where it will sink in and be blown away by the wind.

Don't put it in wash boilers.

Don't use it to kill bedbugs, if you do, remember you have filled the room, and perhaps the house with an explosive vapor. Don't strike a match, or light a fire until the vapor has disappeared.

Don't put clothes or other articles washed with gasoline near the fire to dry.

Don't be fooled by treated gasolines or anti-explosive safety compounds, they are just as dangerous as ordinary gasoline. Treat them with the same care.

One pint makes 200 cubic feet of air explosive, burning gas, or explosive vapor.

Kerosene Oil Lamps.—Kerosene oil itself is safe enough. It is the gas or vapor given off by the oil that is dangerous. This vapor collects in the bowl above the oil. If it is touched by flame in any way an explosion occurs. This is the reason why kerosene lamps explode. Keeping the lamp filled reduces the amount of this vapor. Keeping the lamp clean prevents the oil being heated so that vapor is not produced, therefore;

Keep lamps well filled.

Keep lamps clean, especially the burner and the collar, that is, the metal parts where the wick comes through.

Use only wicks that fit right, that is, don't use small wicks. This leaves an opening for the flame to jump down to the vapor in the bowl.

Before you blow out the light turn down the wick. After the light is out, lower the wick below the top of the tube; this will keep the oil from rising and running over the sides of the lamp.

Don't fill lamps while lighted.

Don't fill lamps within fifteen feet of other lights or fire.

If you are going to fill a lamp that has just been burning, don't unscrew the burner anywhere near other lights or fire. You will release the dangerous vapor and it may travel to the flame and explode.

Buy oil with a high flash test, 120 degrees Fahrenheit if you can get it.

Keep the oil can in a cool place, in a pan, and away from clothes, sawdust, rubbish or other materials that will soak it up.

Don't start the fire with kerosene. It is too risky. If you insist on taking the chance remember this:

Kerosene oil on new kindlings, an absolutely dead fire, a blazing fire, or a cold stove, is safe.

Kerosene oil on a hot stove, on embers or coal, on a dying fire, means an explosion. The first conditions mean the harmless burning of the oil. The second conditions mean the producing of the explosive vapor.

Stoves: Ordinary cooking or heating stoves.—All these should have iron legs or stands to raise them above the floor.

Cover the floor underneath with metal, such as galvanized iron, zinc or sheet iron. Extend this well in front of ash pan, at least a foot, to catch hot coals or pieces of burning wood that may fall. If the stove burns wood, have the metal extend beyond door through which wood is put, to catch ends of sticks that fall out when burned through. In place of this metal protection, a cement base may be put in, building it up on boards set between the beams, after the manner of deafening. Sometimes a dirt base is used, which is a shallow box filled with clay or sand.

Don't set stoves close to woodwork, furred walls, lath and plaster partitions; don't permit broken plaster near stoves, with wood laths exposed. Three feet of clear space should be left around stoves; if less than this, put up a metal shield and have it rise above the height of the stove. With this shield in place, eighteen inches is the limit for safety. Don't nail this shield flat against the wall or partitions. Set it away about an inch, to provide an air space for the heat to circulate. Bright tin is the best heat shield. If you put it up with screw hooks, it can be taken down easily to be polished.

Laundry stoves, kitchen ranges and other stoves of great heat, or with low fire boxes should be set only on floors of fireproof construction. If set on floors built of wood beams covered with floor boards, protect as follows:

First lay down sheet iron, then two courses of brick and place the stove on this brick base. This fireproof base should extend twenty-four inches on all sides of the stove.

Don't set these stoves near woodwork or lath plaster, even if metal shield is put up. Better cut away all woodwork or plaster entirely, and if partitions are needed, build them of brick or incombustible materials.

Large ranges need a metal hood over them, set at least nine inches below the ceiling. This hood should be ventilated by a flue treated exactly as a stove pipe.

Gas Stoves.—Low or Flat Stoves.—Don't buy gas stoves that have not legs or stands to raise the burners at least six inches above the base of the stove.

Don't set these stoves on wood tables, boxes or shelves, unless you cover the wood with raised metal. An inverted metal pan is the thing; punch holes in the side to let the hot air escape. An all metal stand is worth the expense; use an old sewing machine frame, or have a stand built of iron piping or angle iron.

Keep these gas stoves at least a foot away from woodwork or lath and plaster, if nearer, put up a heat shield of metal and have it extend a foot above the stove. Don't set these stoves under a shelf, a mantel, a closet or where paper or cloths will be hung.

Don't use rubber tubing. Put in regular iron piping for all connections, or if you must have a flexible connection, get flexible metal tubing which has screw couplings. Rubber tubing is bad in every way; it wastes gas, catches fire, and by leaking, causes explosions or suffocates people. It is so dangerous that its manufacture and sale should be prohibited.

Gas Ranges With Ovens.—These stoves sometimes make as much heat as a kitchen range and wood floors underneath them require protection equal to a course of brick. A thin covering of cement is not safe enough. Side protection will also be found necessary at times.

Stove or Smoke Pipes.—Be sure these are spark tight. See that the joints are tight and well fitted. The ends of sections should fit in each other three inches. Joints of pipe should open backward to the stove, so that sparks cannot escape through.

Don't set a pipe into a chimney vertically. It must go in at right angles, that is, horizontally. Bends and turns are needed to kill sparks. Don't set a pipe in so far that it stops up the flue. Have the collar at the flue opening fit tight, or it will smoke the wall paper. Don't run these pipes within one foot of woodwork on ceilings or walls, unless you put up a heat shield of metal.

Don't run these pipes through wood floors, ceilings or partitions, lath and plaster partitions, windows, shelves or stock.

Don't run these pipes through closed rooms, closets, attics, dark corners, or any place where the pipe is not always in plain sight. It may break a joint or holes be made unnoticed and sparks escape.

Clean these pipes once a year, the same time that you attend to the chimneys. Jarring the soot out is not enough; a scraper should be used to remove scale. Inspect each section for rust holes or openings in the seams. New pipe will pay for itself in the saving in heat. Cover unused flue openings with metal flue stoppers. Don't plug them with rags or paper, or let the paper hanger cover them when he papers the wall.

Steam Pipes.—All heating pipes to carry steam or hot water as well as ducts to carry hot air should be properly protected when first installed. After they are hidden by the construction of the building, it is nearly impossible to tell if they are safe unless the floors or walls are opened up. Before buying or renting a building, find out about these things. Hire a trustworthy mechanic to go over the house and report on the condition of heating system.

Large feeder or supply pipes, such as main risers, from which branch pipes run, should be covered with non-conducting materials, as well as enclosed in metal sleeves or tubes. The location of these large pipes should be definitely known, in fact, marked on a plan, so that they can be examined if necessary. They should also be arranged so that they can be inspected frequently. Don't permit them to be run in concealed construction, such as under boards on the floor, in hollow partitions, or through closets or closed rooms without ventilation. They should be exposed and in plain sight or run in channels or ducts that are properly arranged for safety.

Small pipes, such as supply radiators, have to be more or less concealed. See that they are kept free of contact with woodwork, with a clear space of two inches. If a metal shield is used, one inch is safe.

If these pipes pass through floors or partitions, they must have a metal sleeve or tube one inch larger than the pipe. Where the pipe comes out of the floor there should be a tight metal collar to keep dust and rubbish from getting into the opening.

If these pipes run horizontally, that is, across the floor and along the beams between the floor boards and the ceiling, they should be run in a metal box or trough to protect the beams and floor boards from the heat.

All boxings or casings for steam or hot water pipes should preferably be of metal, but if wood is used, it should have a heat shield, that is, metal with air space.

If pipes are run in recesses or ducts in walls, the covering should be as above.

Matches.—There is only one safe rule for matches; use only Safety Matches, the kind that have to be struck on the box to be lit. Don't let your family, your servants or your employes use anything else. Pay the match bill for all hands; furnish them with safety matches; it is a good investment for life and property protection.

Next get the habit of being careful with burnt match sticks. Don't throw them away. They are firebrands. Provide metal boxes or receptacles for match sticks. Put them in a safe place. *Make every*body under your control get the safety match habit.

All other matches are fire-makers. They take fire from a hundred insignificant causes. The heads fly off, maybe into your own face, your wife's face or on her light clothing. The sticks break and flaming heads drop somewhere. Rats and mice carry them off to build nests with, and chew on the phosphorus, which is candy for rodents. Glowing match sticks are carelessly thrown everywhere to start unnumbered "cause unknown" fires.

The double dip, double tip, or bird's eye matches are a trifle better than the ordinary parlor match, but not good enough to be worth while using by sensible and intelligent people. Put your faith in Safety Matches; watch the misfortunes of your friends who use the ordinary kind.

If you won't take this fire advice, then keep your matches in metal boxes or stone jars. Don't leave them around loose, where they will be knocked on the floor, or carried off by mice. Don't keep them near fires or lights, or where the children can get them.

Don't let the children play with matches.

If you have closets or rooms where the lights must be lit frequently, or dark halls or rooms, put in a controllable burner, with chains that can be turned up or down, and keep a light burning constantly.

If you use Wind Matches, you ought to be arrested. Even in the woods, people who enjoy outdoor life and the beauty of the forests, ought not to use these miniature torches, or at least, be sure that they are absolutely extinguished before moving on. Consider the forest fires.

Drying Clothes and Laundries.—This causes a few fires. On rainy days, wet clothes will be hung on chairs near stoves or furnaces. On wash days, clothes horses will be placed close to stoves. A wash line will be rigged up in the kitchen too close to the cook stove, or over a gas stove. If this is done, the clothes should be watched and not left overnight unless quite clear of light or flame.

Articles cleaned with gasoline will be dried near stoves. This is dangerous.

In dryers, some articles are overlooked, and left at the bottom of the machine for days. These are liable to take fire some day. Dust and lint will be left to gather on steam pipes connected with dryers until it makes a dangerous fire condition. Wood floors under dryers are very likely to take fire and they should be carefully protected. The practice of drying clothes on radiators results in a number of fires, because people forget about them.

Regulation laundry stoves contain very hot fires, and they should by all means be placed on floors of fireproof construction and not near woodwork, partitions or combustible materials.

CHAPTER LVI.

FIRES IN WEALTHY HOMES.

MANY a Fifth Avenue mansion is not as safe as the modern tenement. This statement is warranted in answer to the question, "Do the wealthy enjoy safety against fire?"

The old style tenement, with its wood stairway, beginning at the cellar, and its wood lath and plaster halls, is passing. That type of building is responsible for the holocausts on the East Side, when a full score of human beings are wiped out at one fire twice and three times a year; but, thanks to former Chief Hugh Bonner and the Tenement House Commission, the newer tenements, with the first floor fireproof and the stairs in a fireproof enclosure, provide a safety for the occupants that is not enjoyed by the wealthy dwellers in more aristocratic buildings.

Take the "brown stone district," for instance. The map shows it plainly. Starting from Washington Square, follow the line of Fifth Avenue. On each side for several avenues are the homes of millionaires and muti-millionaires.

Washington Square, Gramercy Park, Murray Hill, Central Park, East and West, and the Riverside section contain thousands of houses occupied by single families who are accustomed to every comfort and luxury. Many of these are veritable fire traps, for if fire get the least headway there is no hope for the occupants except the arrival of the Fire Department.

To show the truth of this statement consider the fatal fires in houses of this character. Back in the seventies old firemen recall the death of the family of Joseph Stiner, a tea merchant. They had returned from the Purim ball about midnight and retired. In a few hours fire started from a defective chimney flue. It appeared in several places simultaneously and in almost an instant the entire house was in flames. The Fire Department companies on their way could see the light of the fire as soon as they left their houses, and before their arrival all the occupants had perished.

The Goldsmith disaster is another instance and the fire occurred in the same vicinity. Their house was at the corner of Fifty-eighth Street and Pleasant Avenue, the usual brick dwelling house occupied by well to do people. At half-past seven in the evening, a few days before Christmas, 1895, a servant upset a kerosene oil lamp and the fire swept through the house so quickly that five members of the family were lost before the firemen arrived, while the servant jumped from the window.

Disasters Recalled.

Across the city, in the West End section, at No. 260 West Seventy-third Street, three members of the Raymond family perished by fire. This happened a few days before Christmas, 1898. About half past six in the morning the cook came down to prepare the breakfast and discovered the fire under way. It spread through the building so quickly that all escape was cut off.

In January, 1899, two servants lost their lives at a fire in Fifty-fifth Street, near Fifth Avenue, but this fatality was over-shadowed by the burning of the Windsor Hotel on St. Patrick's Day.

At this fire nearly fifty persons were lost, but terrible as this seems in a hotel sheltering several hundred persons, it was to be exceeded within three weeks by a fire in the home of a millionaire. At three o'clock in the morning of April 7, 1899, the Fire Department was summoned to a fire in the house at Sixty-seventh Street and Fifth Avenue. It was occupied by the family of Wallace C. Andrews, president of the New York Steam Heating Company, and some relatives, fourteen persons in all. Before the firemen could render any assistance twelve persons perished and two had to jump from the windows.

While this fire was burning fire started in the home of Albert J. Adams, at Sixty-ninth Street and Fifth Avenue, two blocks away. The two fires may have been a coincidence, but the Adams fire is believed to have been caused by a burning brand from the Andrews fire. In the Adams house one member of the family was killed and six others injured.

In January, 1903, Mrs. Florine Henry, a member of the Lewisohn family, was suffocated in her residence, in East Fifty-sixth Street, while the maid was saved by the firemen.

In January, 1905, W. T. Mason and his wife lost their lives in a vain endeavor to save their three children during the burning of their residence, at No. 133 West 130th Street. In July of the same year Arthur D. Neely was obliged to jump from the window of a fashionable boarding house opposite Delmonico's, in East Forty-fourth Street.

Means of Escape Neglected.

This record of fatal fires speaks for itself and shows how little safety many of the wealthy enjoy. In spite of all the firemen can do, they cannot save people if the fire is under headway.

The Andrews home, for instance, was in the same street with Fire Department Headquarters, where there is an engine company and a hook and ladder company. Give these companies the alarm, and from the first tap of the bell hardly more than a minute will elapse before they reach the house. In spite of this quick response, almost an entire family of fourteen persons perished before the firemen arrived. The harm was done before they could be of any assistance. Do you wonder then that chief officers dread a night alarm from a Fifth Avenue station? No matter how quickly they get there the fire may have headway and some magnificent residences may be destroyed and persons of wealth and refinement suffocated or burned to death.

This state of affairs does not mean that the district is without proper Fire Department protection. It has all the protection that is reasonable and practicable. There cannot be a fire company in every street; the companies respond as quickly as can be expected and the firemen do all in their power to handle the fire properly.

The trouble is with the houses. They were planned and built with little or no regard for fire safety. Means of escape were neglected, while many of the buildings are so constructed that they offer little to check the advance of fire. Moreover, they are not inspected by the city departments, as the tenements are, nor do they even get the inspection by the fire insurance interests which is given to commercial and manufacturing buildings. Almost without exception they are without the modern appliances for discovering and extinguishing fire, and if you were to ask the occupants, "Do you know how to summon the Fire Department?" and "Where is the nearest fire alarm box?" the answer would probably be, "I have never thought of it."

The remedy for this lack of safety lies in improving the buildings. The brown stone rows are a case in point. In some parts of New York are blocks and blocks of them. The front and rear walls have hollow wood furring, while the side walls are partly walls, only twelve inches thick, with stove and furnace flues in them. This means that only one brick, four inches thick, separates woodwork from the heat of the chimney. Examine almost any of these houses and you will find that the wall paper is cracked, the plaster broken and the surface of the wall hot where the flue passes.

What is the matter with these buildings? Ask the fire marshals who investigate the fires or the Fire Department officers who put them out. They will tell you, for instance, of numerous fires caused by chimney flues. Most of these wealthy men's houses, the brown stone rows in the Forties and Fifties, have what are called party walls; that is, the side wall is used by two buildings to carry the beams which support the floors.

Heat from chimneys is a frequent cause of fire, in fact the Fire Marshal's statistics show nearly one thousand fires last year due to this cause. With one exception, more fires are caused each year by chimneys than by any other of the ascertained causes. Fires such as these are especially bad because they are hidden, the same being true of many electric fires nowadays which are started by wires which are out of sight.

A hidden fire is dangerous because it gets into covered recesses, such as pipe channels and behind the plaster, where there is an open space left to prevent dampness. This open space is made by furring the wall; that is, the laths which hold the plaster are not nailed directly to the brick wall, but are set out from it about an inch by being nailed to what builders call "furring strips." This hollow space should be fire stopped at each floor, but this is not done in one house out of a thousand. As a result, once the fire gets in behind the plaster it can work without hindrance from one end of the house to the other and from cellar to garret. It has the wood laths to feed on, and with a natural draught to help it along, it takes only a few minutes to spread from floor to floor. As soon as the laths are burned away the plaster falls off and the fire bursts out into the rooms.

Fires such as these may give off little smoke or the smoke be undetected until at night, when the family is asleep, the fire acquires headway. The occupants may be stupefied by the smoke, or they may not awake until the fire has reached the stairway and escape is cut off.

The stairway is perhaps the worst feature of these houses of the wealthy. In most of them there is only one stairway, which in case of fire becomes a regular chimney for the smoke and flames. The stairs are wood and without any enclosure, or if they are in a hall it is of burnable construction. Thus there is nothing to stop a fire in a room from spreading into the stairway, where there is always a rising current of air, which carries the flames upward with lightning speed. Long before the fire gets into the stairway it cannot be used as an exit on account of the smoke. Persons cannot pass down, and if they run to the roof they find an iron ladder leading to a scuttle which is usually locked or blocked with trunks and stored articles. Seldom if ever is there time to push open the scuttle, and the occupants are compelled to stand at the windows and wait for the firemen.

Absence of a proper stairway leading to the roof, as well as the absence of an ample skylight, is a dangerous defect in any building, as the firemen will tell you. It not only makes it difficult for persons to reach the roof, but it also prevents the fire from getting out through the roof. It is a great mistake to pen in a fire. Experienced firemen always insist upon the necessity of a skylight over a stairway, because their experience shows that it is better to let the fire get out. If an outlet is not provided the fire hits the roof and then burns more fiercely along the top floor and down again to the lower floors, with a veritable mushroom action, which is the reason the top floors suffer most at a fire.

Dangerous conditions such as have just been described exist in the majority of houses, and yet they can be ascertained and measures taken to remedy them. The first thing to do is to take measures for preventing a fire. Stoves, furnaces and chimneys should be examined to see if they are in a safe condition; the gas fixtures and the electric lighting system need inspection, while the use of matches, kerosene, gasolene and other details of housekeeping should be arranged with some regard for fire safety.

Next to preventing a fire by care and watchfulness, the best thing is to have it discovered at the earliest possible moment. In the business buildings a watchman is employed to patrol the premises for this purpose, but in private dwellings this human fire alarm has to be replaced by some mechanical device. There are in use to-day several types of self-acting fire discoverers in the form of thermostats, heat acting mechanisms, such as may be seen on the ceilings of department stores, and also a fire sensitive wire, which can be run all over a house and be as unobserved as a telephone wire. Both the thermostat and the wire are arranged to ring bells throughout the house whenever fire starts, and in the case of one of the fatal fires already described the ringing of an automatic alarm in part of the house resulted in several members of the family escaping.

This interior fire alarm should be supplemented with an alarm for the Fire Department. It is not wise to depend upon some one running to the fire alarm box on the street. This may be one or two blocks away and its location may not be known at the time. Every residence should have its own Fire Department call, so that the occupants can summon the firemen without leaving the house. This would mean the saving of several minutes and enable the firemen to arrive in time to be of service.

Some simple fire extinguishers should also be in the house. A handy pail of water will put out almost any fire in its beginning, and every business building has this simple device spread around. Water pails, however, would appear unsightly in a residence, but their place can be taken by a bucket tank or by a chemical extinguisher. This latter is now made so that it is easily operated and by its prompt use most dwelling fires could be readily put out.

Fire alarms and fire extinguishers are very necessary, but still more important is the question of a fire-escape. Every stairway should be a fire-escape; that is, it should be so constructed that it can be used as an exit in case of fire. This means that it should be enclosed in a fireproof manner, either by four walls or by a hall built of incombustible materials; then it is not only a dependable fire-escape, equal to the emergency of getting ill persons out of a burning house, but it also stops the rapid spread of fire and enables the firemen to arrive in time to catch the fire before it has assumed dangerous proportions. If the stairway cannot be made a fire-escape it is necessary to provide an outside fire-escape with stairs and landing exactly similar to regular stairs.

The preceding suggestions on making a house safe against fire could be followed at a very moderate cost, considering the value of the building and its contents, as well as the fact that the expenditure goes to make the buildings better living places.

CHAPTER LVII.

BUREAU OF FIRE PREVENTION, NEW YORK.

Copy of General Fire Prevention Order.

New York, ..., 191

To .... of..

premises known as ....

....

Borough of ...., New York City.

By virtue of powers in me vested by section 775 of the Greater New York Charter as amended by chapter 899 of the Laws of 1911,

You are Hereby Ordered, within..............days from the date of service hereof, to

(Contents of order.)

Compliance with each requirement of the foregoing order will be enforced as authorized by sections 776, 776-a and 778 of the Greater New York Charter as amended by chapter 899 of the Laws of 1911.

....

Fire Commissioner.

Upon the recommendation of

....

Chief, Bureau of Fire Prevention.

....

Neglect or refusal to comply with a lawful order of the Fire Commissioner is a misdemeanor (Greater New York Charter, section 773), which is punishable by a fine of not exceeding $500, or by imprisonment for not exceeding six months or by both such fine and imprisonment (Penal Law, section 1937), and also subjects the offender to a civil penalty in the sum of $50.

Orders of the Fire Commissioner are reviewable by a Board of Survey, which may be demanded pursuant to the provisions of section 777 of the Greater New York Charter as amended by chapter 899, Laws of 1911.

Attention is invited to the provisions of the Greater New York Charter which are printed on the back of this order.

Copy of Affidavit of Service of Fire Prevention Order.

City and County of New York, ss.:

.............................., being duly sworn, says that he is over the age of twenty-one years, and that he is...... .... in the Bureau of Fire Prevention of the Fire Department of The City of New York; that on the............ ....day of ...., 1912, at No. ...., in the Borough of ...., in said City, he served the within order upon ....by delivering to and leaving with said ....personally a true copy thereof, and that he knew the person so served to be the person named in the foregoing order as ....of the premises described therein.

Sworn to before me this..........
day of...................., 1912.

....
....
....

Copy of Standee Order.

New York, ..., 1912.

To ...., ... of premises known as the .. .., the same being a place of amusement where machinery and scenery are in use, at ...., in the Borough of ...., New York City:

By virtue of powers in me vested by section 775 of the Greater New York Charter as amended by chapter 899 of the Laws of 1911,

You Are Hereby Ordered to prevent the obstruction of any inside aisle or passageway in the above-described place of amusement, at any public performance therein, by any campstools, chairs, sofas or other obstructions or by the standing or sitting of any person in such aisle or passageway;

Provided, however, that where there is a passageway in the rear of the seats in such place of amusement, more than six feet in depth, it shall be lawful to permit persons to stand therein as follows:

(a) If such passageway is more than six feet and less than sixteen feet deep, persons may stand therein, provided an unobstructed passageway of at least six feet in depth is left open, and there are no more than four rows of persons standing;

(b) If such passageway is more than sixteen feet deep, any number of persons or rows of persons may stand therein, provided that an unobstructed passageway of at least ten feet in depth is left open;

(c) And in balconies or galleries, only one row of persons shall be permitted to stand;

(d) And in places of amusement having a passageway in the rear of the seats, six feet or less in depth, but having in addition an outer passageway in the rear thereof, to which all aisle heads have straight and direct access, it shall be lawful to permit two rows of persons to stand in such passageway in the rear of such seats, but under no circumstances any more than two such rows;

(e) And in no event, nor under any circumstances, shall any persons be allowed to stand at the head of any aisle.

The space to be occupied by said standees shall be separated from the space to be left clear for passage, by tape, ribbon, or other easily broken material, supported by light posts fixed in stationary sockets and to be not less than three nor more than four feet from the floor; all to be so constructed and placed as to be no obstruction in case of panic or emergency.

Compliance with each requirement of the foregoing order will be enforced as authorized by sections 776, 776a and 778 of the Greater New York Charter as amended by chapter 899 of the Laws of 1911.

....
Fire Commissioner.

Upon the recommendation of

....
Chief, Bureau of Fire Prevention.

Copy of "No Smoking" Order.

"You Are Further Ordered to prohibit and prevent the smoking of any pipe, cigar or cigarette in the work rooms, stock rooms, packing rooms, toilet rooms, passageways or any other part of the above described premises at any time or by any person, as such practice, in connection with the inflammable nature of the materials used and articles manufactured in said premises, endangers the safety of a considerable number of persons and causes the said premises to be a nuisance within the meaning of Section 776 of the Greater New York Charter, as amended by Chapter 899 of the Laws of 1911, and Section 1530 of the Penal Law."

Fire Don'ts."

. DON'T block the fire escapes, you may need them yourself to-night.

DON'T leave everything to the landlord; inspect your own house from the cellar to garret and locate all exits.

DON'T throw cigars or cigarettes out of windows. They drop on awnings and set them afire.

DON'T allow children to play with matches.

DON'T use matches or candles in dark closets or cellars.

DON'T keep matches except in a tin box with cover attached.

DON'T toss away a match unless completely extinguished, and then toss it into a metal or porcelain receptacle.

DON'T fill lamps or oil stoves while lighted.

DON'T use kerosene oil in lighting fires.

DON'T use naphtha or gasoline for cleaning purposes where there are open lights or fires.

DON'T put hot ashes on a dumb-waiter.

DON'T accumulate old beds and bedding or other trash in cellars.

DON'T allow delivery boys to tie back the dumb-waiter door in cellar; by this means fires have spread throughout buildings.

DON'T neglect to have the chimney flue cleaned once a year. You are responsible, not your landlord.

If you must have lace curtains or other draperies near gas jets, see that the jets are properly protected.

Sending in an Alarm.

Locate the nearest fire alarm box to your home. If it opens with a key, find out who keeps the key.

The ordinary box has no key; you simply turn the handle to the right, open the door and PULL THE HOOK DOWN ALL THE WAY. Wait until the firemen arrive and direct them to the fire.

If you don't know where the nearest alarm box is located, use the 'phone and ask Central for Fire Headquarters, and tell the Fire Department Operator where the fire is.

Regulations.

For the Construction of Outside Fire Escapes.

Unless otherwise approved by the Fire Commissioner in writing, outside fire escapes shall be arranged and constructed as follows:

1. LOCATION.—Iron balconies at least four feet wide shall be located as directed by the Fire Commissioner. They shall communicate one with the other by means of stairs and

with the ground by either stairs or drop ladders as may be ordered. The balconies must be of sufficient length to comply with all the requirements of these Regulations.

2. BALCONIES.—The balconies shall have a landing not less than twenty-four inches square at the head of each stairway. Except in cases where the stairways reach and leave the balconies at the ends, there shall be a passageway at the side of the stairs not less than fourteen inches wide in every part. The stairway opening in each platform shall be of a size sufficient to provide clear headway, and shall be enclosed on the long side by a three-quarter inch rail, well braced.

3. FLOORS OF BALCONIES.—The floors of balconies shall be of wrought iron or steel slats not less than one and a half inches by three-eighths of an inch, placed not more than one and one-quarter inches apart, and well secured and riveted to iron battens one and a half inches by three-eighths of an inch, not over three feet apart and riveted at the intersection. The ends of such floor slats shall project beyond the platform frame, but shall not rest on the bottom rail. The openings for stairways in all balconies shall not be less than twenty-one inches wide and thirty-two inches long, and such openings shall have no covers of any kind. The platforms or balconies shall be constructed and erected to safely sustain in all their parts a safe load at a ratio of four to one, of not less than eighty pounds per square foot of surface.

4. RAILINGS.—Except in the case where stairs are at ends of balconies, the outside top rail shall extend around the entire length of the platform and shall go through the wall at each end and be properly secured by nuts and four-inch square washers at least three-eighths of an inch thick, and no top rail shall be connected at angles by cast iron. Where stairways at ends of balconies make it impossible to secure top rails to walls such top rails must be made rigid and secured by means of inclined braces from the brackets on the outside of the railings, or other means satisfactory to the Fire Commissioner, that will offer no obstruction along the balcony. The top rail of balconies shall be one and three-quarter inches by one-half inch of wrought iron, or one and a half inch angle iron one-quarter inch thick. The bottom rails shall be one and one-half inches by three-eighths of an inch wrought iron, or one and a half inch angle iron, one-quarter inch thick, well leaded or cemented into the wall. The ends of all rails which go through the walls shall be worked out to not less than three-quarter inch bolt size for top rails or one-half inch bolt size for bottom rails, and if constructed as separate pieces shall be properly secured to the rails with not less than two one-half inch rivets. The standards or filling-in bars shall be not less than one-half inch round or square

wrought iron, well riveted to the top and bottom rails and platform frame. Such standards or filling-in bars shall be securely braced by outside brackets at suitable intervals, and shall be placed not more than six inches from centers; the height of railings shall in no case be less than two feet nine inches.

5. STAIRWAYS.—The stairways shall be placed at an angle of not more than sixty degrees, with steps not less than six inches in width and twenty inches in length, and with a rise of not more than nine inches; and shall be constructed and erected to fully sustain in all their parts a safe load at a ratio of four to one of not less than one hundred pounds per step, with the exception of the treads, which must safely sustain at said ratio a load of two hundred pounds. The treads shall be flat open treads, or may be constructed of flat bars, not over one and one-half inches wide, riveted to angle irons of a size not less than one and one-half inch, with the open spaces between such bars not over three-quarters of an inch wide. The strings shall be not less than three-inch channels of iron or steel, or three-eighths by four-inch bars, or two three-eighths by one and one-half inch bars properly latticed or two one-quarter by one and one-half inch angles properly latticed, or other shape equally strong. Unless of channel or angle iron they shall be stiffened by the use of braces properly leaded into or bolted through the wall, and also bolted through the string at a height of not less than seven feet above the floor of the balcony. They shall rest upon and be bolted to a bracket, which shall be fastened through the wall as hereinafter provided. The strings shall be securely bolted to a bracket at the top, and the steps in all cases shall be double-riveted or bolted to the strings. The stairs shall have three-quarter inch handrails of wrought iron, well braced.

6. BRACKETS.—The brackets shall not be less than one-half inch by one and three-quarter inches wrought iron, placed edgewise, or one and three-quarter inch angle iron, one-quarter inch thick, well braced; they shall not be more than four feet apart, and shall be braced by means of not less than three-quarters of an inch square wrought iron, and shall extend two-thirds of the width of the respective balconies or brackets. The brackets shall go through the wall and be turned down three inches, or be properly secured by nuts and four-inch washers at least three-eighths of an inch thick. On new buildings the brackets shall be set as the walls are being built. When brackets are put on buildings already erected the part going through the wall shall not be less than one inch in diameter with screw nuts and washers not less than five inches square and one-half inch thick. If the end going through the wall is separately constructed, it shall be properly connected to the bracket with not less than two five-eighths inch rivets staggered.

7. DROP LADDERS.—Where drop ladders are permitted instead of stairs from the lowest balcony, they shall be of sufficient length to reach from the lowest balcony or platform to a safe landing place beneath. It shall be not less than fifteen inches in width, with strings not less than one-half inch by two inches and rungs of not less than five-eighths of an inch in diameter placed not over twelve inches apart and properly riveted through the strings. Where the lowest balcony is more than fourteen feet above the ground beneath the same, a suitable landing platform shall be provided. Such platform shall be located not more than ten feet above the ground, and shall be connected with the fire escapes above by a stairway constructed as herein required. Such platform shall be not less than four feet in length by three feet in width, and shall be provided at each end with proper railings and a drop ladder to reach the ground. Except as specified, it shall be constructed in conformity with the other provisions of these Regulations.

8. GOOSE-NECK LADDERS.—Wherever possible, a balcony at the top story of any building shall be provided with a goose-neck ladder leading to the roof. Such goose-neck ladder shall be securely fastened to the wall of the building and to the roof, and shall be so located as to afford safe access to the roof. Such ladder shall be constructed as provided for drop ladders; the strings shall be in one piece and shall not be connected in parts by rivets and bolts; such ladders shall be arranged to rest on brackets and not on slats forming the floor of the balcony.

9. SCUTTLE LADDERS.—Scuttle ladders, where required, shall be constructed as above provided for stairs, except that they may be set at a steeper angle. They must be properly secured at top and bottom.

10. PAINTING.—All the parts of such fire escapes shall receive not less than two coats of paint, one in the shop and one after erection. All fire-escape balconies shall contain a plate firmly fastened to the standards or filling-in bars near the top railing, containing in plain, large prominent, raised letters, each letter to be not less than one-half an inch in length, the following words: "Any one placing any encumbrance on this balcony will be fined ten dollars." The lettering on such plates shall be painted with a paint of a color different from that used on the body of the plate, so that the letters will be prominent and distinct.

11. In case it may be desired, for architectural or other reasons, to vary from these requirements in the shape of construction of the brackets or railing, such changes may be submitted to the Fire Commissioner, but shall not be made until his approval has been obtained.

12. WINDOWS.—All windows on same will be required to have metal frames and sashes with wired glass; upper sash to be immovable; lower sash suspended by weights and two metal chains on each side, one chain on each side to have fusible links and these fusible links to be exposed when lower sash is fully opened, weights to be so arranged that when fusible links are opened, by heat, lower sash will be so counter-weighted that it will close surely and slowly, yet be readily opened by hand.

These regulations will take effect December 14, 1911.

Headquarters
FIRE DEPARTMENT OF THE CITY OF NEW YORK,
157-159 East 67th Street.
New York,................, 191..
In the Matter of
THE ORDER OF THE FIRE COMMISSIONER,
affecting the Building known as:
Borough of , New York City.
DEMAND FOR SURVEY.
Fire Commissioner,
City of New York.
Sir:

By virtue of the provisions of section 777 of the Greater New York Charter, as owner of the above-described building, I HEREBY DEMAND A SURVEY THEREOF by surveyors designated as prescribed by law, to determine whether or not the order issued by you, dated........................191... requiring

said building, is valid and reasonable.

New York City,........................191...

....
Demandant.

Headquarters
FIRE DEPARTMENT OF THE CITY OF NEW YORK,
157-159 East 67th Street.
New York,................, 191..
In the Matter of
THE ORDER OF THE FIRE COMMISSIONER,
affecting the Building known as:
Borough of , City of New York.
ORDER OF SURVEY.
(Name of Owner)....................the owner of the above-

described building, having demanded a survey thereof to determine whether or not the attached order of the Fire Commissioner is valid and reasonable, pursuant to the provisions of section 777 of the Greater New York Charter as amended by Chapter 899 of the Laws of 1911,
(Name of Surveyor representing Bureau of Fire Prevention)
....
a........................of the........................
(Name of Architect or Builder)............................
...............an........................of at least ten
years' experience, and......(Name of third Surveyor)........
....
nominated by the Board of Fire Underwriters, ARE HEREBY APPOINTED SURVEYORS and they are hereby directed TO SURVEY THE ABOVE-DESCRIBED BUILDING on the..
..........day of ...., 191..., at.......o'clock in the forenoon and make written report concerning the condition of such building and whether or not the attached order is valid and reasonable, which report shall be filed in the Bureau of Fire Prevention of the Fire Department within two days after the date of such survey.

....
Fire Commissioner.

Headquarters
FIRE DEPARTMENT OF THE CITY OF NEW YORK,
157-159 East 67th Street.
New York,................, 191..
In the Matter of
THE ORDER OF THE FIRE COMMISSIONER,
affecting the Building known as:
REPORT OF SURVEY.

The undersigned Surveyors appointed under and in pursuance of the provisions of section 777 of the Greater New York Charter as amended by Chapter 899 of the Laws of 1911,

DO CERTIFY AND REPORT: That in pursuance of the annexed Order, they met at the time and place therein mentioned, and made a careful survey and inspection of the following premises, to wit:
........building situated on the..................of the lot on
the........side of.......................commencing about
...........feet from the.............corner of.............
and........................, being a................story
.............building about.......................feet front
.............feet rear,.............feet deep, and........

feet high, and occupied as a....................and known as
Number ....
in the Borough of................in The City of New York; that upon such survey and inspection they find the condition of said premises above-described to be as follows:

And they further certify and report the attached order of the Fire Commissioner to be in all respects valid and reasonable.

All of which is respectfully submitted

....
............of the............
....
....
Architect-Builder.
Surveyor appointed upon nomination of Board of Fire Underwriters.

SULLIVAN-HOEY LAW

Bureau of Fire Prevention

AN ACT.

To Amend the Greater New York Charter, in Relation to the Better Prevention of Fires.

The people of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Section seven hundred and twenty-seven of the Greater New York charter, as re-enacted by chapter four hundred and sixty-six of the laws of nineteen hundred and one, is hereby amended to read as follows:

Bureaus.

Section 727. The Fire Commissioner shall have power to organize the Fire Department into such bureaus as may be convenient and necessary for the performance of the duties imposed upon him. There shall be in the department a fire bureau, which under the direction of the Commissioner shall have charge of the extinguishment of fires and the necessary and incidental protection of property in connection therewith. There shall also be established a bureau of fire prevention, which under the direction of the Commissioner shall perform the duties and exercise the powers in relation to the prevention of fires devolved upon the Commissioner by this act or by any other law or ordinance. The official in charge of the Bureau of Fire Prevention shall be known as the chief of the Bureau of Fire Prevention and shall be appointed by the Commissioner. The Commissioner shall also appoint such other officials and subordinates in each borough as may be necessary.

Section 2. Section seven hundred and twenty-eight of the Greater New York charter, as re-enacted by chapter four hundred and sixty-six of the laws of nineteen hundred and one, is hereby amended to read as follows:

Selection of Subordinates.

Section 728. The Fire Commissioner shall have power to select heads of bureaus and assistants and as many officers and firemen as may be necessary, and they shall at all times be under the control of the Fire Commissioner, and shall perform such duties as may be assigned to them by him, under such names or titles as he may confer. Promotions of officers and members of the force shall be made by the Fire Commissioner as provided in section 124 of this act on the basis of seniority, meritorious service in the department, and superior capacity as shown by competitive examination. Individual acts of personal bravery may be treated as an element of meritorious service in such examination, the relative rating, therefore, to be fixed by the Municipal Civil Service Commission. The Fire Commissioner shall transmit to the Municipal Civil Service Commission in advance of such examination the complete record of each candidate for promotion.

Section 3. The heading of title three of chapter 15 of the Greater New York charter, as re-enacted by chapter 466 of the laws of 1901, is hereby amended to read as follows:

TITLE III.

Prevention of Fires—Explosives and Combustible Materials.

Section 760—Shavings; how to be stowed away.
Section 761—Hoistways, iron shutters, etc., to be closed.
Section 762—Lights, precautions against fire and use of aisles in places of amusement.
Section 763—Gunpowder and other explosives; sales thereof regulated.
Section 764—Fireworks and explosive compounds; manufacture and sale thereof.
Section 765—Petroleum and coal oils, etcetera; sale thereof.
Section 766—Idem; continued.
Section 767—Criminal liability if death results from violation of foregoing rules.
Section 768—Fires and lights on vessels transporting petroleum.
Section 769—Storage of certain chemicals regulated.
Section 770—Idem; of certain vegetable products.
Section 771—Right to enter buildings, etc., for purposes of examination.
Section 772—Information to be furnished by holders of permits.
Section 773—Fines and penalties.
Section 774—Duties of Fire Commissioner.
Section 775—Powers of the Commissioner.
Section 776—Fire hazards are nuisances; procedure to abate same.
Section 776a—Reimbursement for expenses; procedure.
Section 777—Right to survey.
Section 777a—Survey; certiorari to view reports of.

Section 777b—Expenses of surveys.

Section 778—Application for order to remove violations and to vacate buildings.

Section 778a—Transmitting notice to owner.

Section 778b—Investigation of fires.

Section 778c—Municipal Explosives Commission.

Section 4. The Greater New York Charter, as re-enacted by Chapter 466 of the laws of 1901, is hereby amended by adding thereto eleven new sections, numbered respectively 774, 775, 776, 776a, 777, 777a, 777b 778, 778a, 778 b, 778c thereof, and to read respectively as follows:

Duties of Fire Commissioner.

Section 774. The Commissioner shall enforce all laws and ordinances in respect of:

1. The prevention of fires.
2. The storage, sale, transportation or use of combustibles, chemicals and explosives.
3. The installation and maintenance of automatic or other fire-alarm systems and fire-extinguishing equipment.
4. The means and adequacy of exit, in case of fire, from all buildings, structures, enclosures, vessels, places and premises in which numbers of persons work, live, or congregate from time to time for any purpose except tenement-houses.
5. The investigation of the cause, circumstances and origin of fires and the suppression of arson.

Powers of the Commissioner.

Section 775. The Commissioner is empowered to:

1. Cause any building, structure, enclosure, vessel, place or premises, or any part thereof, or thing therein or attached thereto, to be examined and inspected by any officer or employee of the department designated for such purpose.
2. Order, in writing, the remedying of any condition found to exist in, on or about any building, structure, enclosure, vessel, place or premises, except tenement-house, in violation of any law or ordinance in respect to fires or to the prevention of fires, except the tenement-house law.
3. Require in writing, the installation, as prescribed by any law or ordinance, in any building, structure or enclosure of automatic or other fire-alarm system or fire-extinguishing equipment and the maintenance and repair thereof, or the construction, as prescribed by any law or ordinance, of adequate and safe means of exit.

4. Require any building, structure, enclosure, vessel, place or premises, which, in the opinion of the Commissioner, is inadequately protected against fire perils to be vacated, or to be condemned and removed.

5. Cause any vessel moored to or anchored near any dock or pier in the city to be removed and secured at such place in the harbor as shall be designated by the Commissioner provided such vessel shall be on fire or in danger of catching fire or is, by reason of its condition or the nature of its cargo, a menace to shipping or to property or the water front of the city.

6. Cause any order of the Commissioner or department which is not complied with within the time fixed in the order for such compliance to be enforced and to take proceedings for the enforcement thereof.

The Commissioner or any authorized officer or employe of the department may enter, at any reasonable hour, any building, structure, enclosure, vessel, place or premises, or any part thereof, to make inspections or in furtherance of the purpose of any provision of this chapter.

Orders of the department or of the Fire Commissioner shall be addressed to the owner or owners, lessees or occupants of the building, structure, enclosure, vessel, place or premises affected thereby, but it shall not be necessary to designate such owner or owners, lessees or occupants by name in any such order, but the premises shall be designated in the address, so that the same may be readily identified. Service of any such order may be made by delivery of a copy thereof to the owner or any one of several owners, to a lessee or any one of several lessees, or to any person of suitable age and discretion in charge or apparently in charge of the premises, or if no person be found in charge of the premises then by affixing a copy of such order prominently upon the premises.

Fire Hazards Are Nuisances; Procedure to Abate Same.

Section 776. Any building, structure, enclosure, vessel, place or premises which is perilous to life or to property in case of fire therein, thereon or adjacent thereto, by reason of the nature or condition of its contents, or its use, or the overcrowding at any time of persons therein, or defects in its construction, or deficiencies in such fire alarm or fire extinguishing equipment as may be required for, on, or in said building, structure, enclosure or premises, by law, or by ordinance, or order of the Fire Commissioner, is a nuisance within the meaning of this act, the penal law and the code or ordinances. The Fire Commissioner is empowered and directed to cause any such nuisance to be abated.

If the person or persons served with an order under the last preceding section shall immediately agree in writing to comply with such order, within such time as the Fire Commissioner deems reasonable, the Commissioner may fix such time as he deems reasonable within which such owner or owners, lessee or lessees may comply with such order; and such owner or owners, lessee or lessees shall immediately employ sufficient labor and assistance to comply with such order as expeditiously as it can be done; but upon the refusal or neglect of a person served with an order of the department to comply with any of the requirements thereof the department may execute such order with its own employees and equipment, or by the employment of other agencies, as the Commissioner may direct, subject to the right of the owner, lessee or occupant of such building, structure, vessel, enclosure, place or premises to demand a survey thereof in respect of such order; provided that nothing contained in this section shall be held to authorize the Commissioner to supply any deficiency in the fire alarm, fire extinguishing or fire escape equipment of any building, structure, vessel, enclosure, place or premises, but in any such case he may prohibit and prevent the occupancy or use of such building, structure, vessel, enclosure, place or premises or public access thereto for any purpose, until the order of the department in respect thereof is complied with.

Reimbursement for Expenses; Procedure.

Section 776-a. The expenses attending the execution of any and all orders duly made by the department shall respectively be a several and joint personal charge against each of the owners or part owners, and each of the lessees and occupants of the building, structure, vessel, enclosure, place or premises to which said order relates, and in respect of which said expenses were incurred; and also against every person or body who was by law or contract bound to do that in regard to such building, structure, vessel, enclosure, place or premises which said order requires, and said expenses shall also be a lien on all rent and compensation due, or to grow due, for the use of any building, structure, vessel, enclosure, place or premises, or any part thereof, to which said order relates, and in respect of which said expenses were incurred.

Right to Survey.

Section 777. The owner, lessee or occupant of any building, structure, vessel, enclosure, place or premises affected by any order of the department, or his agent, may make written demand upon the Commissioner for a survey of such building, structure, vessel, enclosure, place or premises to determine whether or not such order is valid and reasonable, which demand for survey must be served upon the Commissioner or one of his deputies, or a member of the uniformed force of the department, if personal service cannot be made upon the Commissioner or one of his deputies, within forty-eight hours. Sundays and holidays excluded, after the service of the order referred to in such demand. A demand for survey served upon a deputy commissioner or a member of the uniformed force of the department shall be forthwith transmitted to the Commissioner. Upon receipt of a demand for a survey the Commissioner shall immediately issue an order for the same, naming therein three persons to act as surveyors, one of whom shall be an officer or an employe of the Bureau of Fire Prevention or a member of the Municipal Explosives Commission; another shall be an architect or builder of at least ten years' experience and the third a person to be chosen from a list to be furnished by the Board of Fire Underwriters, or provided by the Commissioner, with the approval of the Mayor, in the event of the Board of Fire Underwriters shall not furnish such a list.

The date and hour when the survey shall be made shall be stated in the order therefor. A copy of such order shall be served upon the person demanding the survey at least twenty-four hours before the hour fixed in the order for the holding of such survey and he shall have the right to be present and be heard at the same in person, or by agent or attorney; provided that such copy of an order of survey may be served as provided generally in respect of service of orders of the department, by Section 775 of this act.

Surveys; Certiorari to Review Reports of.

Section 777-a. The surveyors shall meet at the time and place prescribed in the order of their appointment and shall survey the building, structure, vessel, enclosure, place or premises referred to in such order and consider the merits of the order of the department in respect of which the survey has been demanded. After such survey and consideration the surveyors shall prepare and sign a report of their proceedings and determination, which shall be filed in the department and a copy thereof shall be given the person demanding such survey, upon his application therefor. The determination of the surveyors in any such case shall be final and conclusive, subject to review by certiorari by the Supreme

Court, application for which shall be made within four days after the filing of the report of the survey in the department. No order made by the Supreme Court in a proceeding to review the report of a survey shall be appealable.

Expenses of Surveys.

Section 777-b. Each person, other than an officer or employe of the department designated to act as a surveyor, pursuant to the provisions of this article, shall be paid out of the contingent fund of the department the sum of twenty-five dollars for each survey in which he participates, upon the filing of the report thereof in the department. The city shall be entitled to reimbursement for all expenses incident to a survey under the provisions of this article, provided, in the report of the survey, it shall be held that the order of the Commissioner, which was the subject of such survey, was in all respects valid and reasonable.

In case the demand for a survey is made by a lessee or occupant the Commissioner may require, as a condition precedent to the ordering of a survey, that such lessee or occupant shall deposit with the department the sum of one hundred dollars to indemnify the city for the expenses of the survey, in the event the surveyors confirm the order of the department, which sum shall be returned to the depositor in the event the surveyors shall report such order is invalid or unreasonable. No demand for a survey by a lessee or occupant of a building, structure, enclosure, vessels, place or premises shall have any force or effect or be binding in any way upon the Commissioner unless and until such deposit to indemnify the department for the expenses of the survey, if required, shall have been made.

The city may enforce reimbursement for the expenses of a survey against an owner of real property, who in person or by agent has demanded a survey in respect of an order of the department, and shall have a lien upon the property affected by such order in like manner and to the same extent as is provided in Section seven hundred and seventy-six of this act.

Application for Order to Remove Violations and to Vacate Buildings.

Section 778. In case an order issued by the Commissioner or the department is not complied with, or the Commissioner certifies in writing that an emergency exists requiring such action, he may order any building or structure or part thereof to be vacated. Such order shall be addressed and served in the same manner as is prescribed in Section seven hundred and seventy-five for the service of orders. Whenever any order to vacate served as aforesaid shall not have been complied with, within the time designated therein, the Commissioner, in addition to or in lieu of the remedy last above provided, or of any other remedy or power, may apply to the Supreme Court, at a special term thereof, without notice, for an order directing the said Commissioner to vacate such building or premises, or so much thereof as said Commissioner may deem necessary, and prohibiting and enjoining all persons from using or occupying the same for any purpose until such measures are taken as may be required by such order.

Transmitting Notice to Owner.

Section 778-a. In case any order or notice mentioned in or given pursuant to any of the five last preceding sections shall be served upon or given to any lessee or person in possession or charge of the building, structure, enclosure, vessel, place or premises therein described it shall be the duty of such person to give immediate notice to the owner or agent of said building, structure, enclosure, vessel, place or premises named in the notice, if the same shall be known to such person personally, if such owner or agent shall be within the limits of the City of New York, and his residence known to such person; and if such owner or agent be not within said city, then by depositing a copy of such order or notice in any postoffice in the City of New York, properly enclosed and addressed to such owner or agent, at his then place of residence, if known, and with the postage prepaid. In case any lessee or person in possession or charge as aforesaid shall neglect to give such notice as herein provided, he shall be personally liable to the owner or owners of said building or premises for all damages he or they shall sustain by reason of such neglect.

Investigation of Fires.

Section 778-b. The Commissioner through the chief of the Bureau of Fire Prevention, a fire marshal, an assistant fire marshal or the officer of the department lawfully empowered, to administer oaths and take testimony, shall investigate the origin of all fires, and particularly of all cases of supposed arson, incendiarism or fires due to criminal carelessness, which may be brought to the notice of the department or any officer thereof. The officer conducting such an investigation shall have power to summons under supoena and take the testimony, in writing and under oath, of all persons supposed to be cognizant of any fact or to have means of knowledge in respect of the origin and circumstances of any supposed arson, incendiarism or fire due to criminal carelessness. All such testimony, duly verified, with the report of the investigating officer, setting forth his opinion and conclusions in respect of the case, shall be transmitted to and filed in the department. A copy of such testimony and report may be furnished, in the discretion of the Commissioner, to the New York Board of Underwriters, to the owners of property or other persons interested, provided, that in all cases of supposed arson, incendiarism or fires due to criminal carelessness, the Commissioner, or an officer of the department authorized by him shall promptly seek the co-operation of the Police Department and the district attorney of the county in which the supposed crime shall have occurred, and in all such cases the Commissioner shall cause the Police Commissioner and the district attorney to be furnished with copies of the testimony taken and reports made by officers of the department in respect of such supposed arson, incendiarism or fires due to criminal carelessness. All evidence, with the addresses of probable witnesses, in any such case shall be reported by the department to the appropriate district attorney without delay.

Municipal Explosives Commission.

Section 778-c. The municipal explosives commission, as constituted at the date when this act shall take effect, is continued and its members shall hold office during the pleasure of the Mayor. All regulations of such commission approved by the Fire Commissioner, except such as relate exclusively to its organization, or to the duties and discipline of its officers and employes, shall constitute a chapter of the Code of Ordinances of the city, and shall be subject to amendment or repeal by the Board of Aldermen.

Section 5. All acts or parts of acts in so far as inconsistent with the provisions of this act are hereby repealed.

Section 6. This act shall take effect immediately.

EXTRACT FROM THE NEW YORK PENAL CODE.

Section 389. Keeping Gunpowder Unlawfully.—A person who makes or keeps gunpowder, nitro-glycerine, or any other **explosive** or **combustible** material within a city or village, or carries such materials through the streets thereof, in a quantity or manner prohibited by law or by ordinance of the city or village, is guilty of a misdemeanor. A person who manufactures gunpowder, dynamite, nitro-glycerine, liquid or compressed air or gases, except acetylene gas or other gases used for illuminating purposes, naphtha, gasoline, benzine or any explosive articles or compounds or manufactures ammunition, fireworks or other articles of which such substances are component parts in a cellar, room or apartment of a tenement or dwelling house or any building occupied in whole or in part by persons or families for living purposes, is guilty of a misdemeanor. And a person who by the careless, negligent, or unauthorized use or management of gunpowder or other explosive substances, injures or occasions the injury of the person or property of another, is punishable by imprisonment for not more than two years. Any person or persons who shall knowingly present, attempt to present or cause to be presented or offered for shipment to any railroad, steamboat, steamship, express or other company engaged as common carrier of passengers or freight, dynamite, nitroglycerine, powder or other explosives dangerous to life and limb, without revealing the true nature of said explosives or substance so offered or attempted to be offered to the company or carrier to which it shall be presented shall be guilty of a felony, and upon conviction, shall be fined in any sum not exceeding one thousand dollars and not less than three hundred dollars or imprisonment in a State prison for not less than one or more than five years, or be subject to both such fine and imprisonment. Nothing in this section shall be construed to prohibit or forbid the manufacture and sale of soda water, seltzer water, ginger ale, carbonic or mineral water, or the charging with liquid carbonic acid gas of such waters or ordinary waters, or beer, wines, ales or other malt and vinous beverages in such cellar, room or apartment of a tenement or dwelling house, or any building occupied in whole or in part by persons or families for living purposes.

TENEMENT HOUSE LAW.

Chapter 179, Laws of 1903, State of New York.

Chapter II., Title III., Provisions applicable to all Tenement Houses hereafter erected or now existing.

Section 40. Combustible materials.—No tenement house, nor any part thereof, nor of the lot upon which it is situated, shall be used as a place of storage, keeping or department in the same manner and like extent, and to be sued for in like manner as in the preceding part of this section provided for.

Lights, Precautions Against Fire and Use of Aisles in Places of Amusement.

Section 762. All lights used in theatres and other places of public amusement, manufactories, stores, hotels, lodging houses and the show windows shall be properly protected by globes or glass coverings, or in such other manner as the Fire Commissioner shall prescribe. The owners and proprietors of all manufactories, hotels, tenement houses, apartment houses, office buildings, boarding and lodging houses, warehouses, stores and offices, theatres and music halls, and the authorities or persons having charge of all hospitals and asylums, and of the public schools and other public buildings, churches and other places where large numbers of persons are congregated for purposes of worship, instruction or amusement, shall provide such means of communicating alarms of fire, accident or danger, to the Police and Fire Departments respectively as the Fire Commissioner or Police Board may direct, and shall also provide such fire hose, fire extinguishers, buckets, axes, fire hooks, fire doors, and other means of preventing and extinguishing fires as said Fire Commissioner may direct. In every building used or occupied as a hotel, lodging house or public or private hospital or asylum, there shall be employed by the owner or proprietor, or other person or persons having the charge or management thereof, one or more watchmen, whose exclusive duty it shall be to visit every portion of such building, at regular and frequent intervals, under rules and regulations to be established by the Fire Commissioner for the purpose of detecting fire or other sources of danger, and giving timely warning thereof to the inmates of the building. In every room in each of said buildings there shall be posted a card, upon which shall be printed a diagram showing the exits, halls, stairways, elevators and fire escapes, and in the halls and passageways, signs shall be posted indicating the location of the stairs and fire escapes. In each of the said buildings there shall be placed and provided electrical or other alarms and time detectors, to be approved by the Fire Commissioner, by means of which the movements of said watchman may be recorded, and through which alarms of fire or other danger may be instantly communicated, by means of bells or gongs, to every portion of the building. Said electrical apparatus, and all other appliances placed or kept within any of said buildings for the purpose of preventing or extinguishing fires, or for affording means of escape therefrom in case of fire, shall be kept at all times in good working order and proper condition for immediate use, and any member of the uniformed force of said department may enter any of said buildings at any time for the purpose of inspecting said apparatus or appliances. The Fire Commissioner may detail, not to exceed two members of the uniformed force of said department, at each and every place of amusement where machinery and scenery are in use, while such place is open to the public, whose duty it shall be to guard against fire, and who shall have charge and control of the means provided for its extinguishment, and shall have control and direction of the employes of the place to which they may be detailed for the purpose of extinguishing any fire which may occur therein. It shall also be the duty of such member or members of the uniformed force of said department to inspect every portion of the building or buildings to which they have been detailed, during the public performances therein, for the purpose of guarding and protecting the occupants from fire or panic. Whenever any member of the uniformed force of said department shall discover in any inside aisle or passageway in any such place of amusement any camp stools, chairs, sofas or other obstructions or any person or persons standing or sitting therein during any public performance, it shall be the duty of such member of the uniformed force forthwith to notify the proprietor or manager of such place of amusement, or any usher, agent or other employe of such proprietor or manager then present, to cause such obstruction to be forthwith removed, or to cause the person or persons standing or sitting in such aisles or passageways to forthwith vacate the same. If the manager or proprietor, or such usher, agent or employe shall cause or permit any camp stools, chairs, sofas or other obstructions to be placed or remain in the aisle or passageway in any such place of amusement, or shall cause, or permit any person to stand or sit therein during any public performance, or, having been so notified, shall neglect or refuse to cause such obstruction to be forthwith removed, or to cause such person or persons to forthwith vacate said aisles or passageways, they shall each severally be deemed to have violated the provisions and requirements of this title and the regulations or orders duly made thereunder, and shall be subject to the penalties prescribed in this act. In all places of public amusement or entertainment, not included in the foregoing provisions, except in fireproof buildings, there shall be employed, by the owner or proprietor thereof, one or more watchmen whose exclusive duty it shall be to protect and guard the inmates of such buildings from fire and other sources of danger.

Gunpowder and Other Explosives, Sales Thereof Regulated.

Section 763. (Repealed by passage of following ordinance by Board of Aldermen, May 13, 1902.)

An Ordinance to Regulate the Sale, Use and Transportation of Explosives in The City of New York. (Changing Section 763 of the Greater New York Charter.)

Section 763. Be it ordained by the Board of Aldermen of The City of New York, as follows:

1. Within thirty (30) days after the passage of this ordinance there shall be a municipal explosives commission which shall be constituted as follows: The said commission shall consist of five (5) members; the Fire Commissioner of The City of New York shall be ex-officio chairman and a member of the said commission. The remaining four (4) members shall be appointed by the Mayor, and one of the said four (4) must be appointed from a list of ten to be submitted by the New York section of the American Chemical Society. The said commission shall hold office during the pleasure of the Mayor.

2. It shall be the duty of the said commission to formulate and adopt such regulations as in its judgment may be necessary to carry out the purpose of this ordinance, and from time to time to add to or in any way change or amend such regulations. The said regulations and the amendments thereto and any changes which shall be made therein shall be subject to approval by the Mayor, and when so approved shall be published by the Fire Commissioner in the City Record, and in such other manner as he shall deem necessary.

3. Said commission, hereby established, shall meet at the call of the Fire Commissioner for the consideration of all matters pertaining to this ordinance, and each member thereof shall receive a fee of ten dollars ($10) for attendance at each meeting. A majority of such commission shall constitute a quorum for the purpose of doing business.

4. No person, firm or corporation, shall have, keep, sell, use, give away or transport, any gun powder, blasting powder, gun cotton, dynamite, nitro-glycerine, or any substance

or compound or mixture or article having properties of such a character that alone or in combination or contiguity with other substances or compounds it may decompose suddenly and degenerate sufficient heat, or gas, or pressure, or all of them, to produce rapid flaming combustion or administer a destructive blow to surrounding persons or things, within the corporate limits of The City of New York, excepting in the manner and upon the conditions herein provided, and under license issued by the Fire Commissioner under such regulations as the Municipal Explosives Commission shall prescribe. The said Fire Commissioner shall have power to revoke the license or licenses in case, in his judgment, there is an infraction of the provisions of this ordinance or of the regulations of the Municipal Explosives Commission.

5. No licensee shall employ any one in the use or care of explosives such as are used in blasting operations unless such person shall hold a certificate of fitness issued to him by the Fire Commissioner under the regulations established by the Municipal Explosives Commission.

6. No gun powder, blasting powder, dynamite, gun cotton, nitro-glycerine, or such other explosives as may be hereafter designated for prohibition under this ordinance by the Municipal Explosives Commission shall be manufactured in the said city.

7. No holder of a license hereunder can avail himself of any of the privileges of the same until he shall have filed a bond with the same commissioner in the penal sum of not less than one thousand dollars ($1,000) nor more than five thousand dollars ($5,000), to be approved by the Comptroller, the amount of the said bond to be determined by the regulations as prescribed by the Municipal Explosives Commission, said bond to be conditioned for the payment of any loss, damage or injury resulting to persons or property from explosions and for the strict observance of this ordinance and the regulations made hereunder.

8. The Municipal Explosives Commission may, by a unanimous vote of its members, subject to the approval of the Fire Commissioner, provide for an increase of the amount of the bond to be filed with the said commissioner, in accordance with Section 7 of this ordinance, to an amount not exceeding twenty-five thousand dollars ($25,000), said bond to be approved by the Comptroller in accordance with Section 7 of this ordinance.

9. In case of the violation of the provisions of this ordinance or regulations on explosives, even though no damage to persons or property be sustained, twenty (20) per cent. of

said bond for the first infraction and the whole amount for the second offense shall be forfeited therefor and paid over to and for the use and benefit of the Relief Fund of the Fire Department of the City of New York.

10. The commander, owner or owners of any ship or vessel arriving in the harbor of New York, and having more than twenty-eight (28) pounds of gun powder or other explosive named in this ordinance on board shall, immediately upon arrival and before such ship or vessel shall approach nearer than 300 yards of the pier line of said city, give written notice to the Fire Commissioner of the fact that such explosives are on said vessel. And all vessels having on board or loading explosives exceeding twenty-eight (28) pounds shall cause to be displayed at the masthead nearest the land while remaining within the city limits a red flag at least five feet square, and no ship or vessel shall lie at the pier after sunset having more than twenty-eight (28) pounds of explosives without a permit from the said commissioner, said permit to be issued for not exceeding forty-eight (48) hours.

11. Nothing in this ordinance shall be construed to apply to any ship or vessel of war in the service of the United States or any foreign government while lying at a distance of 300 yards or upward from the pier line of said city, nor to any ship or vessel of war in the service of the United States while lying in any part of the Navy Yard in the Borough of Brooklyn.

12. This ordinance shall take effect immediately. Adopted by the Board of Aldermen May 13, 1902. Approved by the Mayor May 19, 1902.

Fireworks and Explosive Compounds; Manufacture and Sale Thereof.

Section 764. No fireworks, detonating works, cartridges, powder train, percussion caps, collodion, nitrate of soda, nitrate of silver, ether, phosphorus, matches, or explosive compounds, or explosive substances shall hereafter be manufactured in the city, except at such places, in such manner, and in such quantities as shall be determined by the said commissioner in the exercise of his discretion, under a permit by him granted therefor, and subject to be revoked at any time by said commissioner. Fireworks, consisting of Chinese crackers, rockets, blue lights, candles, colored pots, lance-wheels, and other works of brilliant-colored fires, may be kept upon sale intervening the tenth day of June and the tenth day of July each year, by retail dealers, under such reasonable regulations as said commissioner may prescribe, under a permit, issued therefor.

Petroleum and Coal Oils, Etc.; Sale Thereof.

Section 765. No person shall have, keep on sale, or store in any place or building within the corporate limits of the city, any crude petroleum, coal or any similar oil, nor any of their products, either of which shall emit an inflammable vapor at a temperature below one hundred degrees Fahrenheit, except under the following provisions; or any of their products may be stored in detached and properly ventilated warehouses, the outer walls of which shall be stone, brick or iron, especially adapted for the purpose by having raised sills, at least two feet high, or the ground floor of which shall be at least two feet below the level of the street or adjoining yard, or so constructed as to actually prevent the overflow of such substances beyond the premises where the same may be kept stored. Said warehouses shall not be occupied in any part as a dwelling; and if less than fifty feet from any adjacent dwelling the same must be separated by a brick or stone wall, at least ten feet in height and sixteen inches thick, constructed in such manner as said commissioner may prescribe, but the same may be stored in such other manner as said commissioner may designate under a special permit issued therefor. No refined petroleum, kerosene, coal or similar oil, or earth or rock oil, or machinery oil, or any product thereof to be used for illuminating or heating purposes which shall emit an inflammable vapor at a temperature below one hundred degrees Fahrenheit, shall be kept upon sale or stored within the corporate limits of the city. All said articles shall be tested and their quality determined by sanitary surveyors authorized by said commissioner, using G. Tagliabue's instruments, or such other instruments as may be designated by said commissioner, the barrels or packages containing the same to be legibly stamped or marked with said inspector's official stamp or mark. No refined petroleum, kerosene, gasoline, naphtha, or benzine, benzole, camphene, or burning fluid, or products or compounds containing any of said substances, when temporarily placed above the cellar or basement of any building, and in barrels of not over forty-five gallons each, or in metallic vessels or tanks, shall exceed in the whole quantity the contents of fifty of said barrels; provided, however, that the whole quantity of said refined oils that may be so kept or stored over night shall not exceed the contents of ten of said barrels, unless stored in the manner provided for storing crude petroleum; and when stored in cellars or basements, surrounded by walls of brick or stone, and at least two feet below the level or grade of the sidewalk, street or land adjacent, the whole quantity shall not exceed the contents of 150 barrels, unless stored in warehouses specially adapted for that purpose, as required for the storage of crude petroleum under this section: provided, also, that no quantity of said oils greater than one barrel shall be stored or kept in any building occupied in any part thereof as a dwelling. No refined petroleum, kerosene, gasoline, naphtha, benzine, benzole, camphene, burning fluid or products or compounds containing any of said substances shall be kept or stored on or above the first story or floor of any building, exceeding in the whole quantity the contents of five barrels of forty gallons each. In no case shall any of the articles named in this section be allowed to remain on the sidewalk beyond the front line of any building, or in or upon the streets, docks, piers, bulkheads, slips, highways or public places a longer time than is actually necessary for the removal or loading of the same, and said commissioner may establish and enforce general regulations and issue such orders and special directions relative to the handling, lightering, carting, loading and transportation of the several articles named under this section as in his discretion shall be deemed necessary for the public protection, and said commissioner may issue special permits authorizing the keeping of any of the articles enumerated under this section in buildings, tanks or structures fireproof throughout, in such quantities, in such manner, and subject to such regulations, as shall tend to secure the same against danger.

Section 766. No person shall sell at retail or give away any kerosene, or other product of petroleum, or any similar oil to be used for heating or illuminating purposes, without first obtaining a license therefor from the Fire Commissioner, under such rules and regulations as he may prescribe, which license shall be for the term of one year and shall not be transferable, and for every such license and for every renewal of the same the said commissioner shall demand and receive the sum of ten dollars. Said license shall be posted in a conspicuous place in the store of the person or persons to whom the same is issued and may be revoked for cause by said commissioner. Any person who shall sell any of the compounds above mentioned in this or the last section, without first obtaining a license therefor, shall forfeit and pay the sum of twenty-five dollars.

Criminal Liability If Death Results from Violation of Foregoing Rules.

Section 767. In case any person is burned by the explosion of any compound, the sale of which is prohibited by any law or ordinance, or which has not been subjected to sanitary survey, or licensed as therein provided, and death ensues therefrom, the person found guilty of selling the same shall be deemed guilty of a felony, and, upon conviction, shall be punished by a fine of not less than one thousand dollars, nor more than five thousand or by imprisonment in the State prison for a term not less than one year nor more than five years; and in case of a bodily injury the party injured may maintain an action for damages against the party violating the provisions of this title. Any dealer who shall present and deliver for sanitary survey a sample of oil different from, and which does not represent the quality of oil actually kept by him or her for sale, and not taken from the actual stock being offered for sale, and of the same quality therewith, shall forfeit and pay the sum of fifty dollars. If any fire insurance company organized under the laws of this State, or any insurance company of any other State, or any foreign insurance company authorized to do the business of insurance in this State, shall indorse upon any policy issued by them the right or privilege to keep, deal in, give away, sell, or use any article or compound of a combustible or explosive character, the sale of which is made unlawful, or shall cause or permit such indorsement to be made by others upon their policies of insurance, they shall for each and every such offense forfeit and pay a fine of five hundred dollars.

Fires and Lights on Vessels Transporting Petroleum.

Section 768. It shall be unlawful for the owner, or for any of the officers, employes, or crew of any ship, vessel, canal boat, barge, lighter, boat, or other craft lying at or within one hundred and fifty feet of any warehouse, yard, shed, dock, pier, bulkhead, wharf, or other place within The City of New York, at, in, or on which petroleum oil, or any of its products, is stored, or kept for export, or in quantities exceeding ten thousand gallons; or, for any other person or persons, to bring, keep, have, or use, or suffer or permit to be brought, kept, had, or used on board of any such ship, vessel, canal boat, barge, lighter, boat, or other craft, or at, in, or on any such warehouse, shed, yard, dock, pier, bulkhead, wharf, or other place, any lighted match, or lighted cigar, cigarette, or pipe, or any fire or light of any kind, without, or otherwise than in strict conformity with, the written permission of the owner, lessee or superintendent of such warehouse, shed, yard, dock, pier, bulkhead, wharf, or other place, specifying the fire or light to be kept, had, or used, the particular purpose for, and the place or spot at which the same may be so kept, had, or used, and the particular manner of keeping, having, or using the same. This section shall not apply to steam tugs while transacting their ordinary business, nor to steam fire engines engaged in extinguishing fires. Every violation of this section shall be a misdemeanor, triable before the Court of Special Sessions.

Storage of Certain Chemicals Regulated.

Section 769. (Repealed by passage of following ordinance by Board of Aldermen, May 13, 1902.)

An Ordinance to Regulate the Sale, Use and Transportation of Explosives in The City of New York, (Changing Section 769 of the Greater New York Charter.)

Section 769. Be it ordained by the Board of Aldermen of The City of New York as follows:

1. No person, firm or corporation shall have, use, keep, sell or give away any substance or compound or mixture having such properties that it may, spontaneously or acting under the influence of any contiguous substance, or of any chemical or physical agency, ignite, inflame or generate inflammable vapors to a dangerous extent within the limits of The City of New York, except in the manner and upon the conditions herein provided and under such regulations as the Municipal Explosives Commission shall prescribe. The Fire Commissioner of said city, under and in pursuance of regulations established by the Municipal Explosives Commission, may issue licenses to any person desiring to have, use, keep, sell or give away any of the articles designated in this section. The Municipal Explosives Commission shall prepare such regulations as in its judgment may be necessary to control the storage and handling of the materials specified in this section, and it shall from time to time add to such list and bring under such regulations such other materials as the public safety may require. Said regulations and the amendments thereto shall be subject to approval by the Mayor, and when so approved shall be published by the Fire Commissioner in the City Record and in such other manner as he may deem necessary.

2. This ordinance shall take effect immediately. Adopted by the Board of Aldermen May 13, 1902. Approved by the Mayor May 19, 1902.

Of Certain Vegetable Products.

Section 770. No quantity of cotton, hay, straw, flax, hemp, husks, rushes, oakum, rags, seaweed, jute or other vegetable fiber when pressed or baled greater than twenty tons in the whole, shall be stored or kept in any building within The City of New York, unless kept in a building fireproof throughout, or upon an open space of ground surrounded by a wall constructed entirely of fireproof materials, at least twelve feet high, and twelve inches thick, or within a fireproof building, remote or distant at least fifty feet from any adjacent building, or in a building approved by the New York Board of Underwriters or the Fire Commissioner, and of which approval a certificate shall have been issued by said board or commissioner, and shall not have been revoked; and none of the articles enumerated in this section, when loose or not baled, shall be kept as aforesaid in quantity exceeding one thousand pounds in the whole; excepting in a private stable, in which may be kept such loose hay and straw in quantity not exceeding twenty-five hundred pounds in the whole, except upon the approval of the Fire Commissioner. No person shall have, put, or keep any hay or straw uncovered in any stack or pile, or in any other way exposed, with one hundred yards of any building in said city, or shall have, put or keep within said city any hay, straw, hemp, flax, shavings, or rushes in any building not built of stone, or brick, or iron, or covered with tile or slate, or other fireproof material, which is or shall be within ten feet of any dwelling house or chimney whatsoever except upon like approval.

Right to Enter Buildings, Etc., for Purposes of Examination.

Section 771. The Commissioner and his officers or agents, under the direction of the Commissioner, or either of them, are hereby empowered at any and all times to enter into and examine all buildings, dwelling houses, livery and other stables, hay boats, or vessels, and places where any merchandise, gunpowder, hemp, flax, tow, hay, rushes, firewood, boards, shingles, shavings, or other combustible materials may be lodged, for the purpose of ascertaining all violations of any law or ordinance, and also the places where ashes may be deposited, and upon finding that any of them are defective or dangerous, or that a violation of any law or ordinance exists therein, may deliver a written or printed notice, containing a copy of the provisions in reference thereto, and notice of any violation thereof, and notice to remove, amend, or secure the same within a period to be fixed therein. And in case of neglect or refusal on the part of such occupant or of the possessor of such combustible materials, or any of them, so to remove, amend, or secure the same within the time and in the manner directed by the said commissioner in such notice, the party offending shall forfeit and pay, in addition to any penalty otherwise imposed, the sum of twenty-five dollars, and the further sum of five dollars for every day's neglect to remove, amend, or secure the same after being so notified. All the expenses of any removal, alteration or amendment as aforesaid, shall be paid in the first instance by the occupant, but shall be chargeable against the owner of such dwelling house or other building, and shall be deducted from the rent of the same, unless such expense be rendered necessary by the act or default of such occupant, or unless there be a special agreement to the contrary between the parties.

Information to Be Furnished by Holders of Permits.

Section 772. All persons or corporations who shall be required to have and obtain permits shall furnish such information as may be required, touching the condition of any building and the business therein proposed to be conducted, preliminary to obtaining such permits.

Fines and Penalties.

Section 773. Any person, persons, or corporations, for the violation of, or non-compliance with, any of the several provisions of the several sections of this title, when the penalty is not therein specially provided, shall severally forfeit and pay a fine or penalty in the sum of fifty dollars for each and every offense, or shall forfeit and pay the penalties respectively imposed under any of the said sections, and shall also be severally liable for any costs or expenses that may be incurred by any violation of, or non-compliance with, any requirement under said sections, and shall also be severally liable for the payment of the further penalty of the sum of fifty dollars for any violation of, or non-compliance with, any regulation, order or special direction issued by said Commissioner, or for failure to attend and testify as required by any subpoena issued, as authorized under this chapter. Said commissioner may, in his discretion, pay a portion of a fine, or penalty when collected, not to exceed one-half thereof, to any person giving information of any such violation. All suits and proceedings authorized by this title, or to recover any penalty for the violation of or failure to comply with any law or any rule, regulation, order or requirement of, or made pursuant to the provisions of any law, the enforcement of which is charged upon said department or any of the several bureaus thereof, shall be brought by and in the name of the Fire Commissioner of The City of New York, but no fees or costs shall be demanded of said department in any such suit or proceeding. Any person who shall willfully violate, or neglect or refuse to comply with any provision or requirement of this title, or any regulation, order or special direction duly made thereunder, shall also be guilty of a misdemeanor.

FIRE FIGHTING

A SCHOOL *and* COLLEGE COURSE FOR FIREMEN EVERYWHERE

COMPILED BY
JOSEPH J. O'REILLY
EDITOR

The Chief
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INDEX

AISLE, Crowded 126
ALARM, 9, 14, 15, 18, 30, 31, 58, 59, 60, 64, 71, 76, 77, 79, 80, 81, 82, 176, 177, 178
ALARM VALVE 18, 58, 59
ALLEN, Zachariah 1
ANIMAL OILS 3
APPARATUS 12, 15, 16, 22, 63, 80, 126
APPLIANCES, Fire, 2, 3, 4, 6, 7, 9, 12, 14, 15, 16, 17, 19, 23, 30, 31, 34, 60, 65, 126, 129, 130
APPROVED DEVICES, Lists 9
ASBESTOS 115, 130
ASCH BUILDING 12
ASH CANS 138
ATKINSON, EDWARD 1, 2, 3, 4, 6, 7, 8, 13, 20, 87
ASHES, Cause of Fire 126, 137, 203
  Rules for Care of 137, 138, 203
  Safety Receptacles for 136, 137
AUTOMATIC SPRINKLER "HEAD" .... 4, 18, 57, 66.
AUTOMATIC SPRINKLERS (See Sprinklers)
  Automatic Alarms (See Alarms)
  Automatic Extinction 17
  Automatic Extinguishing 15
  Automatic Fire Extinguishers 17
  Automatic Operation of Wire Glass Windows 115
  Automatic Release fo Fire Door 20
AUXILIARY FIRE APPLIANCES 34, 60
BARS, "Z" Bars 101
  Panel Bars 102
BATTEN 134
BATTERIES 77, 78
BEAMS 7, 84, 119, 120, 121
BELT HOLES 13, 83, 101
BENZINE 141, 204, 205
BI-CARBONATE OF SODA 16, 40, 44
BIN, Packing 133, 134, 135, 136, 137
BLOW PIPE 130
BOSTON MUTUAL INSURANCE COMPANY 2
BRACKETS, For Steel Rolling Shutters 110
  Gas 127
BRICK WALLS 4, 83, 84, 85, 86, 100, 101, 119, 120, 121, 124
BRIDGES 85
BUILDING ALARM 15
BUILDINGS, 5, 7, 11, 12, 13, 15, 26, 27, 29, 83, 112, 114, 116, 117, 118, 119, 120, 121, 126
BULKHEAD 124
BUREAU OF FIRE PREVENTION 26, 216, 225
BURGLARY 69, 71
CALL, Fire Department 15, 63
  Call, By Central Office Station Signal 72
CAN 138, 139, 141
CAPS, On Couplings 48
CARBONIC ACID GAS 16, 40
CARRIERS, Fire 13
CASEMENT, Windows 115
CASK, Water 39
CAUSES OF FIRE 3, 11, 12, 21, 126, 137, 199, 203, 208, 209, 213
CEILINGS, Thermostats on 15
  Protection 127
CELLAR, Equipment for Fire Extinguishing 65
CELLULOID, Precautions in Handling 142, 143
  Danger 203, 204
CENTRAL OFFICE SYSTEM 14, 63, 69, 71
  Runners 71, 72
  Fire Signal 72
  Mechanism of 72
  Value of 72, 73
CHAFING STRIPS 97

CHANNELS, Pipe ... 13
CHARRED WOOD ... 71
CHARTER OF GREATER NEW YORK ... 26, 27, 28, 29, 30, 31, 32, 65
CHEMICAL EXTINGUISHERS ... 15, 38, 40, 41, 42, 43, 44, 45
CHIMNEY ... 30, 132
CHLORIDE OF CALCIUM ... 38
CIGARS ... 133, 208
CINDER, Blocks ... 124
CITY, Reimbursement ... 28, 29
CLAPPER VALVE ... 67
CLOCK, Portable Watch ... 14, 72, 73
  Stationary Watch ... 14, 69, 73
  Operation of ... 71
CLOSETS ... 126
CODE, National Electrical ... 75
  New York Building ... 65, 127
COIL, Testing ... 82
COLLINWOOD, OHIO, School Fire ... 24, 160
COMBUSTION ... 3, 40, 133, 137, 138
COMMUNICATIONS ... 83, 85, 86
CONCEDED SPACES ... 3
CONCRETE ... 96, 99, 121, 124
CONFINING OF FIRE ... 14
CONFLAGRATIONS ... 17, 105, 112
CONNECTIONS ... 14, 46, 48, 54, 58, 62, 65, 67
CONSTRUCTION ... 3, 4, 5, 7, 12, 19, 112, 119, 120, 121, 124
CONTROL OF FIRE ... 14
COPPER ... 40, 42, 115
CARE, Wood in Fire Door ... 90
  Wood in Window Shutters ... 113
CORNICE ... 84, 85
CORPS, Salvage ... 63, 64
CORROSION ... 62, 81
  In Chemical Extinguishers ... 40
COUPLINGS ... 48
COTTON ... 3, 140, 142
CROSBY, U. C. ... 9
CURTAIN ... 12, 109, 110, 111, 112, 127
DEFLECTOR, Sprinkler ... 6, 17, 18, 57
DEPARTMENT, Fire ... 11, 15, 17, 18, 23, 28, 29, 31, 64, 65, 72, 114, 136
DEPARTMENT STORES ... 6, 15
DESTRUCTIVE DISTILLATION ... 113
DETECTION OF FIRE ... 14
DETECTORS ... 14, 69, 81, 82
DIAL ... 69, 71
DIRT, Cause of Fire ... 199, 209
DISCOVERY OF FIRE ... 14, 15
DISEASE, Fire ... 11
DISTRICT ATTORNEY, Evidence and Reports to ... 29
DOOR ... 3, 4, 19, 20, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 100, 101, 102, 103, 104, 126
DOORWAYS ... 4, 122
DRAW-OFF VALVES ... 59
DRY PIPE VALVES ... 58, 60
DRY POWDER EXTINGUISHERS ... 16
DUST, Explosive ... 7
ELECTRIC ... 60, 61, 69, 71, 75, 77, 79, 127, 131
ELECTRICAL SPECIFICATIONS Woodbury ... 7
ELEVATORS ... 7, 13, 44, 122
ENGINE ... 55, 60, 62, 131, 140
ENGINEERS ... 7, 11, 117
ENGINEERING, Fire Prevention ... 2, 7, 11
EXCELSIOR ... 133, 134, 135
EXHAUST, Chamber ... 131
  Pipe ... 131
  Pipe in Flue or Chimney ... 132
EXIT ... 31, 44, 144, 148, 173, 174, 175
EXPERT, Fire ... 11, 12, 22, 24
EXPLOSIVES ... 32
EXPLOSIVE DUST ... 7
EXPOSURE ... 12, 16, 20, 84, 105, 106, 109, 112, 114
EXTINGUISHER ... 15, 16, 17, 36, 37, 38, 39, 57, 62
EXTINGUISHING, AUTOMATIC ... 15
FACTORIES ... 76, 133, 137, 138, 142
FACTORY IMPROVEMENT COMMITTEE ... 9
FACTORY MUTUAL INSURANCE SYSTEM ... 1, 2, 8, 13
FAULTS OF MANAGEMENT ... 126

FIRE, 11, 14, 15, 16, 30, 31, 72, 83, 84, 112, 113, 114, 115, 126, 133, 136, 187-191, 192-198
FIRE ALARM COMPANY 60
FIRE CHIEF 26
FIRE COMMISSIONER 26, 27, 28, 29
FIRE DRILL 23, 24, 76, 144, 148, 149, 150, 151
FIRE ESCAPES 44, 144, 148
FIRE HAZARDS, Nuisances 27
FIREMAN, Trained 17, 31
FIREPROOF 12, 13, 119, 120, 121, 124, 137
FIRE STOP 86, 87, 112, 113
FILINGS, Soaked Oil 126
FLOORS 3, 59, 122, 123
FRAME 57, 98, 99, 100, 102, 114, 115, 119
FRANCIS, JAMES B. 2
FRAUDULENT OIL SAMPLES 32
FREEMAN, JOHN R. 7
FREEZING 38, 45
FUEL, Gas 129, 130
FURNITURE, Metal 9
FUSIBLE LINK 4, 57, 103, 104, 115, 135
GARAGE 140, 141
GARBAGE 136, 138
GAUGE, Pressure 60
GAS 3, 16, 113, 127, 128, 129, 131
GASOLINE 141, 204, 205
GATE VALVE 58, 59
GENERATOR, Electric 71
GIRDERS 7, 120, 121
GLASS 112, 114, 115
GLAZING 115
GONGS, Alarm 77
"GRAFT," In Inspection 118
GRAVITY 18, 20, 60, 77
GRAY, JOSEPH P. 7
GRINNELL, FREDERICK 6
GUARANTEE, Of Fire Alarm System 77, 78
HAND GRENADES 16
HAND PUMP or SYRINGE 16
HARDWARE, For Fire Door 89
HARD SILVER 77
HAZARDS, Fire 12, 131
"HEAD," Sprinkler 4, 18, 57, 33, 64, 66
HEAT 12, 103, 112, 113, 114, 126, 137
HIDDEN FIRES 193, 194
HINGES 97, 98, 107
HOEY ACT 26-33
HOLES 13, 83, 101, 126
HOLLOW CONSTRUCTION 3
HOMES 185, 188, 210, 215
HOSE 3, 16, 17, 42, 50, 52
HOW TO PUT OUT A FIRE 192-198
HYDRANT 61
HYDROSTATIC TESTS 43
ILLEGAL PRIVILEGE IN INSURANCE POLICY.......... 32
IMPROVING PRESENT BUILDINGS 13
INCOMBUSTIBLE MATERIALS 20, 21, 121, 122
INSPECTION 3, 10, 24, 25, 26, 116, 118, 157, 159
INSPECTOR 116, 117, 118, 157, 159
INSTALLATION 22, 96, 97, 103
INSURANCE 11, 62, 129, 131, 136, 141
INTERIOR ALARM 15
INVESTIGATION, Duty of Commissioner 29
IRON, 61, 67, 75, 86, 97, 98, 99, 101, 102, 107, 108, 109, 110, 111, 112, 113, 115, 119, 120, 129, 130, 131, 138
IRON DOORS 4, 86, 87
JET, Gas 127, 128
KALAMINE 115
KEROSENE 205, 206
KEY 69, 73, 75
LABEL SYSTEM, Und. Lab. 10
LABORATORIES, Fire 2, 3, 9, 10, 43
LANTERNS 3, 74, 75
LATCHES 98, 103, 104, 107
LATH FURRING 94
LAUNDRY, Fire Danger 209
LEAD 42, 44, 57, 113

LEAKAGE, Notice of 63, 64
LEVER 20, 87
LIGHT 12, 30, 126
LIGHTING APPARATUS, Cause of Fire 12
LINTEL 96
LISTS, Approved Devices 9
LOCK-JOINTED TIN 7, 91, 113, 133
LOWELL, MASS., MILLS, Fire Protection in 2
LUBRICATING OILS 3
MAGNETO 71, 72, 73, 75
MAIN GATE VALVE 59
MAINTENANCE 24, 42, 43, 44, 62, 104
MANAGEMENT, Bad- -Cause of Fire 199-209
MANUAL, Fire Alarm Box 64, 80
MASS. INSTITUTE OF TECHNOLOGY 7
MATCHES 3, 133, 208, 209
METAL FURNITURE 9
METALS, 20, 57, 60, 61, 67, 75, 77, 81, 86, 88, 91, 98, 99, 101, 102, 103, 107, 108,
109, 125, 129, 130, 131, 132, 137, 138
METER, Water 61
MILL CONSTRUCTION 7, 119, 120
  Illustration 5
MUNICIPAL EXPLOSIVES COMMISSION 29, 31, 32
MUTUAL FIRE INS. CO. 88
MUTUAL INSURANCE SYSTEM, Factory 1, 2
NAILS 92, 93, 107, 133
NAPHTHA 141, 204, 205
NATIONAL BOARD OF FIRE UNDERWRITERS, 9, 10, 40, 74, 88, 89, 90,
91, 92, 95, 100
NATIONAL FIRE PROTECTION ASSOCIATION, 9, 40, 88, 89, 90, 91, 92, 95, 100
NEGLECT OF PREVENTION 11
NESTS, Rats 3, 7
NEW ENGLAND MILLS 1, 3, 5, 6, 120
  New England Insurance Exchange 9
NEW JERSEY DEPT. OF LABOR 76
N. Y. BOARD OF FIRE UNDERWRITERS 129, 131
N. Y. FIRE INSURANCE EXCHANGE 129, 131
NOTES, Inspector's 117, 118
NOTICES 26, 27, 29, 33
NOZZLE 42, 52
OIL OF VITRIOL 40, 44
OIL SOAKED COTTON 3
OIL 3, 75, 104, 126, 131, 137, 140, 202, 205, 206
ORDERS 26, 27, 29, 33, 216-225
ORDWAY, JOHN M. 8
OPENINGS 4, 13, 19, 83, 84, 94, 95, 96, 100, 101, 106, 122, 123, 125, 126
OWNER OF BUILDINGS 24, 27, 28, 29, 33, 35, 126
OXYGEN 3, 113, 133, 137, 138
PACKING MATERIALS 126, 133, 134, 135
PAILS, Fire 15, 35, 36, 37, 38, 39
PAINT 111, 140
PANIC 23
PAPER 128, 133, 136, 137, 142
PARMELEE, THOMAS J. 6
PATROL, Fire 14
PERFORATED PIPE SPRINKLERS 2, 6, 17, 65, 67, 68
PERMITS, Information 33
PIERCE, F. L. 7
PINE, White 134
PIPE 2, 6, 13, 17, 65, 67, 130, 207, 208
PIPING 46, 53, 54, 55, 57, 58, 65, 67
PITCH, Heating of 130
PIVOT, Wire Glass Windows 115
PLANK 7, 13, 120
PLASTER, Blocks 124
PLATINUM 77
PORTABLE WATCH CLOCK 14, 69, 72, 73
POSTS 7
PREMISES, Untidy 126
PREMIUMS, Insurance 11
PRESENT BUILDING, Improving 13
PRESSURE 42, 55, 60, 61, 63
PREVENTION, Fire 1, 2, 8, 11, 12, 22, 83, 116, 152-156, 199-209, 216-225
PRINCIPLES, Fire Prevention 11
  Principles of Safety 12
PRISM, In Windows 115

PROTECTION 16, 101, 112, 127, 128, 152-156
PUBLIC ALARM 15
PUBLIC WATER WORKS 60, 61
PUMP 3, 16, 60, 61
PUSH-BUTTON 76
RABBET 134
RADIATION, From Hot Iron 112
RAGS 139, 140
RATE 131, 136, 141
RATS, Nests 3, 7
RECORDER 69, 75, 80
RECORDS 44, 45, 72, 73, 75, 80
REGULATIONS, Bureau of Fire Prevention 216-225
RETARDING OF FIRE 19-21
RICHARDS, E. G. 9
RIGHT OF ENTRY 27, 32
RISERS 18, 46, 53, 54, 55, 58
ROOFING TIN 4
ROOFS 3, 12, 121
ROUNDSMAN, WATCHMAN 15
RUBBER 130, 131
RUBBISH 12, 126, 136, 138, 139, 199, 201
RUNNER, Watchman 15, 71, 72
SAFE BUILDING, The Standard 12
SAFEGUARDS 22
SAFETY 12, 22, 23, 24, 74, 75, 83, 88, 136-140, 141, 164, 165, 166, 210-215
SALT, Prevents Freezing 38
SALVAGE CORPS 63, 64
SAND, Pails 38
  In Concrete 96
SASH 114, 115
SAWDUST, Cause of Fire 126
SCHEDULE, Watchmen 15
SCHOOLS 24, 160-184
SCIENCE OF FIRE PREVENTION 1, 2, 8
SELF-CLOSING WASTE CAN 138
SELF INSPECTION 3
SHAFTS 13, 83, 101, 117, 122, 124, 125
SHAVINGS, Care of 31
SHIELD, For Combustible Materials 127
SHIPS, Dangerous 27
SHUTTERS 12, 19, 20, 107, 108, 109, 112, 113, 114
SIGNALS 15, 63, 71, 72, 82
SIGNS, Exit 31
  Signs, Perforated Pipes 67
SILLS 95, 96, 99
SINGER TOWER 53, 54, 55
SKELETON BUILDINGS 120, 121
SKYLIGHTS, Fire Brands 12
  Neglected 126
SKYSCRAPER 53
  Singer Tower 53
SLOW BURNING CONSTRUCTION 5, 7, 119, 120
SMOKE, Starts Panic 23
SODA, Bi-Carbonate of 16
SOLDER 18, 20, 57, 79, 81, 130
SOOT 133
SPARKS 133
  In Celluloid Manufacture 143
SPECIAL BUILDING SIGNAL 15
SPECIALIST, Fire 11, 22
SPECIFICATIONS 7, 12
SPLASH PLATE 6, 17, 57
SPONTANEOUS COMBUSTION 3, 133, 137, 138
SPRINKLERS 2, 3, 4, 6, 7, 9, 16, 17, 18, 57, 61, 62, 63, 66
STAIRS 122
  Boxed 125
  Escapes 146, 147
STAIRWAYS 7, 13, 122, 124, 125
STANDARD OIL COMPANY 3
STANDARDS 9, 11, 12, 14, 22, 23, 24, 72, 73, 74, 94, 95, 96, 113, 138, 139, 141
STANDEE REGULATION 31
STANDPIPE 3, 16, 46, 47, 48, 49, 50, 51, 52
STATIONARY WATCH CLOCK 14, 69, 71, 73
STATIONS 71, 72, 74, 75
STEAM 61, 130

STEEL 60, 61, 67, 90, 102, 109, 110, 121, 137, 138
STOCK, Crowded, Piled 125
STOCK FIRE INS. CO. 88
STONE 95, 99, 119, 120
STORAGE, Cause of Fire 12
STOVE 35, 37, 129
STREAMS, Hose 16, 17
STREET 18, 57
SUB CELLAR 65, 67
SUITS 33
SULLIVAN-HOEY LAW 26-33
SULPHURIC ACID 16, 40, 44
SUPERVISION 9, 69, 71, 72
SURVEY 27, 28, 29
SURVEYORS 28
SWEEPINGS, Cause of Fire 126
SYSTEM, 2, 3, 4, 6, 7, 8, 9, 12, 13, 14, 18, 57, 58, 59, 60, 61, 62, 63, 64, 68, 69,
71, 72, 76, 77, 78, 79, 80, 81, 82
TANKS 15, 16, 18, 39, 40, 52, 60
TELEGRAPH COMPANY 71, 72
TELEGRAPH CONNECTION, Watchmen 14
TEMPERATURE 38, 43, 45, 57, 63, 79, 81, 82, 114, 143
TENANTS, Aid to Inspector 117, 118
TERNE PLATE 88
TERRA COTTA 124
TESTS 43, 78, 82, 114
THEATRE 31, 152-159
THERMOSTAT 14, 64, 79, 80
TICKER 71
TIDD, M. M. 8
TILE, Hollow 124
TIMBER 7, 13, 84, 120
TIME 69, 74, 75, 78
TIME DETECTORS, Watchmen 14
TIN 4, 7, 57, 86, 88, 91, 101, 107, 113, 133, 135, 136, 137
TOWERS, Brick 7
TRACKS 20
TRANSMITTER 63, 80, 82
TUBE 81, 130, 131
TUNNELS 85
UNDERWRITERS 9, 10, 40, 74, 88, 89, 90, 91, 92, 93, 94, 95, 100, 129, 131
UNDERWRITERS' LABORATORIES 9, 10, 43, 73
UNDERWRITER, Fire Door 4
Fire Pump 7, 61
UNIFORMED FORCE, Control of 26
VALVE 18, 48, 50, 54, 58, 59, 67
VIOLATIONS 33
VOLATILE 141, 142
VENTILATING SHAFTS 13
VENTILATION, Of Buildings in Fire 114
VERTICAL OPENINGS 13, 122
Vertical Standpipes 16
WALLS 3, 7, 19, 21, 83, 84, 85, 86, 119, 120, 121, 122
WASHINGTON PLACE FIRE 12
WASTE CANS 126, 137
WATCHMAN 3, 9, 14, 15, 30, 31, 69, 71, 72, 74, 75
WATCH CLOCK 14, 69, 71, 72, 73
WATER 4, 12, 15, 17, 18, 52, 54, 60, 61
WEDGE 93
WEIGHTS 103, 104
WELL, Elevator 122
WESTON, BYRON 4, 8, 87
WHAT TO DO IN CASE OF FIRE 187-191
WHITING, WILLIAM B. 7
WIND 106
WINDOWS 9, 12, 19, 20, 84, 112-115, 122, 126
WIRE 15, 77, 112-115, 127, 128
WIRE GLASS WINDOWS 9, 12, 20, 21, 112-115
WOOD 88, 90, 112, 113, 114, 127, 131, 133, 134, 135, 139
WOODBURY, C. J. H. 7

STEEL 60, 61, 67, 99, 102, 109, 110, 121, 137, 138
STOCK, Crowded, Piled 126
STOCK FIRE INS. CO. 88
STONE 96, 99, 119, 120
STORAGE, Cause of Fire 12
STOVE 206, 207, 129
STREAMS, Hose 16, 17
STREET 18, 57
SUB-CELLAR 65, 67
SUITS 33
SULLIVAN-HOEY LAW 26-33
SULPHURIC ACID 16, 40, 44
SUPERVISION 9, 69, 71, 72
SURVEY 27, 28, 29
SURVEYORS 28
SWEEPINGS, Cause of Fire 126
SYSTEM, 2, 3, 4, 6, 7, 8, 9, 12, 13, 14, 18, 57. 58. 59. 60. 61. 62, 63. 64, 68, 69. 71, 72, 76, 77, 78, 79, 80, 81, 82
TANKS 15, 16, 18, 39, 40, 52, 60
TELEGRAPH COMPANY 71, 72
TELEGRAPH CONNECTION, Watchmen 14
TEMPERATURE 38, 43, 45, 57, 63, 79, 81, 82, 114, 143
TENANTS, Aid to Inspector 117, 118
TERNE PLATE 88
TERRA COTTA 124
TESTS 43, 78, 82, 114
THEATRE 31, 152-159
THERMOSTAT 14, 64, 79, 80
TICKER 71
TIDD, M. M. 8
TILE, Hollow 124
TIMBER 7, 13, 84, 120
TIME 69, 74, 75, 78
TIME DETECTORS, Watchmen 14
TIN 4, 7, 57, 86. 88, 91, 101, 107, 113, 133, 135, 136, 137
TOWERS, Brick 7
TRACKS 20
TRANSMITTER 63, 80, 82
TUBE 81, 130, 131
TUNNELS 85
UNDERWRITERS 9, 10, 40, 74. 88, 89, 90, 91, 92, 93, 94, 95, 100, 129, 131
UNDERWRITERS' LABORATORIES 9, 10, 43, 73
UNDERWRITER, Fire Door 4
  Fire Pump 7, 61
UNIFORMED FORCE, Control of 26
VALVE 18, 48, 50, 54, 58, 59, 67
VIOLATIONS 33
VOLATILE 141, 142
VENTILATING SHAFTS 13
VENTILATION, Of Buildings in Fire 114
VERTICAL OPENINGS 13, 122
  Vertical Standpipes 16
WALLS 3, 7, 19, 21, 83, 84, 85, 86, 119. 120, 121, 122
WASHINGTON PLACE FIRE 12
WASTE CANS 126. 137
WATCHMAN 3, 9, 14, 15, 30, 31, 69, 71, 72, 74. 75
WATCH CLOCK 14. 69. 71. 72, 73
WATER 4, 12, 15, 17, 18, 52, 54, 60, 61
WEDGE 93
WEIGHTS 103, 104
WELL, Elevator 122
WESTON, BYRON 4, 8, 87
WHAT TO DO IN CASE OF FIRE 187-191
WHITING, WILLIAM B. 7
WIND 106
WINDOWS 9, 12, 19, 20. 84, 112-115, 122, 126
WIRE 15, 77, 112-115, 127. 128
WIRE GLASS WINDOWS 9, 12, 20. 21, 112-115
WOOD 88, 90, 112, 113, 114, 127, 131, 133, 134, 135, 139
WOODBURY, C. J. H. 7